



# MISSOURI State Freight & Rail Plan

## TRUCK PARKING PROFILE



NOVEMBER 2021



# Table of Contents

<b>1.0</b>	<b>Introduction and Overview .....</b>	<b>1</b>
<b>2.0</b>	<b>Truck Parking Analysis.....</b>	<b>5</b>
2.1	Inventory/Supply .....	5
	Publicly Owned Inventory.....	6
	Privately Owned Inventory .....	9
	Total Inventory .....	11
2.2	Demand/Users .....	13
	Data Overview.....	14
	Inventory Used for Demand and Gap Analysis.....	14
	Raw Demand Results .....	17
2.3	Gap Analysis .....	19
	Developing Expansion Factors .....	19
	Gap Analysis – Designated Parking Sites .....	21
	Trucks Parked on Interstate Right of Way .....	30
2.4	Truck Parking and Other Factors.....	39
	Safety .....	39
	Restrooms .....	43
	Truck Volumes .....	44
	Top Freight Generators.....	45
<b>3.0</b>	<b>Truck Parking Outreach.....</b>	<b>47</b>
3.1	Truck Driver Survey .....	47
3.2	Truck Driver Roundtable .....	52
	What Missouri Does Well.....	52
	Areas that Need More Truck Parking.....	53
	Optimal Resource Allocation.....	53
	Communication .....	54
<b>Appendix A.</b>	<b>Publicly Owned Truck Parking Site Profiles .....</b>	<b>55</b>
<b>Appendix B.</b>	<b>Truck Parking GPS Data Preparation.....</b>	<b>87</b>
B.1	Data Handling and Pre-Processing.....	88
B.2	Analysis.....	89
B.3	Post Processing and Special Cases .....	90
<b>Appendix C.</b>	<b>Truck Driver Survey Questions .....</b>	<b>92</b>

C.1	Demographic/Fleet Questions .....	92
C.2	Truck Parking Needs.....	93
<b>Appendix D.</b>	<b>Truck Driver Roundtable Question Guide .....</b>	<b>98</b>

# List of Tables

Table 1.1	Summary of Federal HOS Regulations .....	2
Table 1.2	How Firms Can Influence the Truck Parking Decision .....	3
Table 2.1	Publicly Owned Truck Parking Inventory by MoDOT District .....	8
Table 2.2	Privately Owned Truck Parking Inventory by MoDOT District .....	11
Table 2.3	Total Truck Parking Inventory by MoDOT District .....	13
Table 2.4	Total Truck Parking Inventory by Interstate Corridor (within 1 mile) .....	13
Table 2.5	ATRI Data Collection Periods .....	14
Table 2.6	Truck Parking Inventory Included In Gap Analysis .....	17
Table 2.7	Truck Parking Inventory and Gap by District .....	25
Table 2.8	Truck Parking Inventory Included In Gap Analysis .....	32
Table 2.9	Truck Parking Inventory and Gap by District .....	37
Table 2.10	Contributing Circumstances For Other Vehicles Involved in Crashes With Truck Parking-Related Contributing Factors.....	40
Table 3.1	Truck Parking Amenity Preferences .....	50
Table 3.2	Truck Parking Scenarios.....	51





# List of Figures

Figure 1.1	Types of Truck Parking and Challenges.....	1
Figure 2.1	Overview of Truck Parking in Missouri .....	6
Figure 2.2	Missouri Publicly Owned Truck Parking Inventory .....	7
Figure 2.3	Amenities at Publicly Owned Truck Parking Sites .....	8
Figure 2.4	Missouri Privately Owned Truck Parking Inventory .....	10
Figure 2.5	Missouri Total Truck Parking Inventory .....	12
Figure 2.6	Truck Parking Polygon Example – Wright City Rest Area and Interstate ROW .....	15
Figure 2.7	Truck Parking Inventory Included in Gap Analysis .....	16
Figure 2.8	Missouri – Duration of Truck Stop by Stop Location .....	18
Figure 2.9	Missouri – Duration of Stop by public or Private Designated Truck Stop .....	18
Figure 2.10	FHWA Vehicle Classes.....	20
Figure 2.11	Locations for Expansion Factor Calculation and truck Parking Inventory .....	21
Figure 2.12	Truck Parking Demand at Designated Sites by Time of Day .....	22
Figure 2.13	Time of Peak Demand at Designated Truck Parking Sites .....	22
Figure 2.14	Love's 341 – Parked Trucks Example .....	23
Figure 2.15	Missouri Truck Parking Gap at Designated Parking Sites Within ½ Mile of the Interstates .....	24
Figure 2.16	Gap At Peak Hour by MoDOT District .....	26
Figure 2.17	Truck Parking Utilization Infographic .....	27
Figure 2.18	Site Utilization Category by Ownership .....	28
Figure 2.19	Missouri Truck Parking Utilization at Publicly Owned Designated Parking Sites Within One-Half Mile of the Interstates.....	29
Figure 2.20	“Raw” Trucks Stopped on Interstate ROW by Highway/County .....	31
Figure 2.21	Trucks Parked By Hour of Day (Interstate ROW) .....	32
Figure 2.22	“Raw” Trucks Stopped on Interstate ROW Example – I-70 in Cooper County.....	35
Figure 2.23	Site Gap and Trucks Parked In Interstate ROW.....	36
Figure 2.24	Gap At Peak Hour by MoDOT District (Sites and Interstate ROW).....	38
Figure 2.25	Trucks Parked at Caruthersville Weigh Station (I-155) .....	39
Figure 2.26	Missouri Truck-Involved Crash Contributing Circumstances.....	41
Figure 2.27	Missouri Truck Parking and Related Truck Crashes by Severity (2015-2019).....	42
Figure 2.28	Crashes Related to Trucks Improperly Parked, Improperly Stopped on Roadway and Improper Start From Park Within One Mile of a Designated Truck Parking Site .....	43
Figure 2.29	Site Utilization and Presence of Restrooms at Publicly Owned Sites .....	44
Figure 2.30	Site Utilization and Truck Volumes .....	45
Figure 2.31	Site Utilization, ROW Parking and Top 50 Freight Generating ZIP Codes.....	46
Figure 3.1	Truck Driver Survey Interactive Mapping Tool .....	48

Figure 3.2	Survey Results: What Type of Truck Parking do You Regularly Need in Missouri? .....	49
Figure 3.3	Survey Results: Difficulty in Finding Truck Parking by Type .....	49
Figure 3.4	Survey Results: Improvements to Limited Amenity Facilities .....	51
Figure 3.5	Usefulness of Truck Parking Availability System On Interstate Corridors .....	52
Figure 3.6	Diagram of Accuracy and Precision.....	87
Figure 3.7	Example of Raw Data Points at Boonville Rest Area .....	88

# 1.0 Introduction and Overview

Nearly every item we buy, from clothes to food to electronics, at some point ends up in the back of a truck. Trucks provide the main transportation mode for freight in Missouri, carrying approximately 40% of all freight by weight and 43% by value in 2018. Our constant demand for goods means more trucks on the road and with it an increased demand for safe, reliable places to park.

Truck drivers typically need to park for one of five reasons shown in Figure 1.1, each of which comes with a challenge.

**FIGURE 1.1 TYPES OF TRUCK PARKING AND CHALLENGES**



Source: Texas Statewide Truck Parking Study

This need to park is driven by several factors. First, the Federal Motor Carrier Safety Administration regulates hours of service (see Table 1.1). HOS provisions have a significant impact on truck parking because they require drivers to carefully time deliveries and schedule adequate rest, making sufficient parking critical on their routes and deliveries.<sup>1</sup> One notable change which took effect in September 2020 allows drivers who use a sleeper berth to split their sleeper berth rest period instead of taking a single 10-hour off-duty period. However, since GPS data used for this analysis is from 2019, the 10-hour off duty period will appear as a single stop in the truck parking analysis.

<sup>1</sup> "Jason's Law Truck Parking Survey Results and Comparative Analysis."  
[http://www.ops.fhwa.dot.gov/freight/infrastructure/truck\\_parking/jasons\\_law/truckparkingsurvey/ch1.htm](http://www.ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch1.htm).



TABLE 1.1 SUMMARY OF FEDERAL HOS REGULATIONS

HOS Provision	Description
11-Hour Driving Limit	May drive a maximum of 11 hours after 10 consecutive hours off duty. May be extended by up to two hours when a truck driver encounters adverse driving conditions.
14-Hour Limit	May not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty. Off-duty time does not extend the 14-hour period. May be extended by up to two hours when a truck driver encounters adverse driving conditions.
30-Minute Driving Break	Drivers must take a 30-minute break when they have driven for a period of 8 cumulative hours without at least a 30-minute interruption. The break may be satisfied by any non-driving period of 30 consecutive minutes (i.e., on-duty not driving, off-duty, sleeper berth, or any combination of these taken consecutively).
60/70 Hour Limit	May not drive after 60/70 hours on duty in 7/8 consecutive days. A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.
Sleeper Berth Provision	Drivers may split their required 10-hour off-duty period, as long as one off-duty period (whether in or out of the sleeper berth) is at least 2 hours long and the other involves at least 7 consecutive hours spent in the sleeper berth. All sleeper berth pairings MUST add up to at least 10 hours. When used together, neither time period counts against the maximum 14-hour driving window.
Short-Haul Exception	A driver is exempt from the above requirements if: the driver operates within a 150 air-mile radius of the normal work reporting location, and the driver does not exceed a maximum duty period of 14 hours. Drivers using the short-haul exception must report and return to the normal work reporting location within 14 consecutive hours and stay within a 150 air-mile radius of the work reporting location.

Source: <https://www.fmcsa.dot.gov/regulations/hours-service/summary-hours-service-regulations>

The HOS rules are designed to eliminate the type of drowsiness that can lead to crashes. HOS regulations are strongly enforced by state agencies and fines for non-compliance can be high. To avoid the steep fines and negative impact to their safety rating, drivers are under pressure to find parking as quickly and efficiently as possible to avoid violating HOS regulations while trying to meet stringent delivery schedules.

The mandatory use of electronic logging devices in most commercial vehicles as of April 2018 has sharpened the focus on truck parking issues.<sup>2</sup> ELDs are intended to reduce instances of unsafe, fatigued driving by more closely monitoring a driver's HOS than was possible using paper logs. Because ELDs track a driver's position in real-time, drivers are more careful to search for and find parking before their HOS are up (thus sacrificing driving time and decreasing productivity) or park immediately once their time is up, regardless of location to comply with HOS requirements and avoid potential fines.

**CHOOSING AN ELD**

Motor carriers and drivers must choose an ELD that is self-certified and registered on FMCSA's website. Motor carriers must self-certify that their ELDs meet technical standards in the ELD rule and they must register them with FMCSA. View the list of self-certified ELDs on FMCSA's website: <https://epdo.fmcsa.dot.gov/ELDs/Default.aspx>

**Why FMCSA Implemented the ELD Rule**

The rule is intended to help create a safer work environment for drivers, and make it easier and faster to accurately track, manage, and share HOS data. As part of the MVD-21 Act, Congress required adoption of the ELD rule.

**Get More ELD Information**

Visit [www.fmcsa.dot.gov/ELD](http://www.fmcsa.dot.gov/ELD) to:

- Access Frequently Asked Questions for in-depth information on the rule.
- Sign up for the ELD newsletter to receive email updates.
- Visit the Training and Events section for upcoming opportunities hosted by FMCSA.
- Learn about using ELDs in the Drivers and Carriers section.
- Find a list of self-certified and registered ELDs.

**Electronic Logging Device (ELD) Rule**

FACTS for the Commercial Motor Vehicle Industry

U.S. Department of Transportation  
Federal Motor Carrier Safety Administration

Phone: 800.852.6880 | Email: [eld@dot.gov](mailto:eld@dot.gov) | [www.fmcsa.dot.gov/ELD](http://www.fmcsa.dot.gov/ELD)

Twitter: [twitter.com/fmcsa](https://twitter.com/fmcsa) | Facebook: [facebook.com/fmcsa](https://facebook.com/fmcsa)

APR 2017 FMCSA-ELD-17-008

<sup>2</sup> Certain drivers are exempt from this requirement including those that use paper records for less than 8 days in a 30-day period. See: [Electronic Logging Device \(ELD\) Exemptions, Waivers and Vendor Malfunction Extensions | FMCSA \(dot.gov\)](#). Accessed February 2, 2020.

Beyond HOS, many other factors influence when and where a driver decides to park. For example, the driver could be carrying a load for a facility with a very strict delivery window (time when the driver can arrive on-site), and drivers can face fines or potentially lose future business if they are not there on-time. In a heavily congested area or corridor, this requirement may influence a driver to park as close to the facility as possible to not risk missing their appointment. If parking is not available in a designated location, they may seek to park in an undesignated spot instead.<sup>3</sup> Similarly, a driver may be forced to wait longer than planned for a facility to load their truck, impacting their ability to reach a planned stopping place later in their trip. Table 1.2 below shows some of the factors that influence where trucks park based on the various companies involved in a supply chain.

**TABLE 1.2 HOW FIRMS CAN INFLUENCE THE TRUCK PARKING DECISION**

Principal Agent	Truck Company/Driver	Origin/Receiver	Infrastructure/ Parking Provider	Regulator or Enforcement <sup>4</sup>	Other Public Entities
<b>Key Objective</b>	Manage operational costs and reduce under-utilized miles (empty or non-revenue producing trips)	Manage inventories with logistical solutions	Provide parking for safety reasons (public) or for profit (private)	Improve traffic safety	Community safety
<b>Potential Areas of Control</b>	The truck route, equipment, in-transit parking decisions	Time of pick-up/delivery	Build and maintain parking, signage, driver notifications concerning parking slots	Safety inspections, citation authority, operational allowances, time	Land use, truck routes, restricting truck operations
<b>What They Do Not Control</b>	The truck destination, last mile parking, zoning issues, truck operational bans	Smaller sites -near site parking (larger sites may provide some parking areas or could provide space)	Demand for parking by location or time	Hours of pick-up/delivery	Shippers need to receive cargo

Source: Institute for Trade and Transportation Studies, *Thoughts on the Challenges Associated with Public Sector Planning for Truck Parking Facilities*. 2016

<sup>3</sup> Note that in many cases, businesses will not allow a driver to park on property prior to or after a delivery.

<sup>4</sup> Note that in Missouri, the regulator and enforcement are shared between MoDOT, Missouri State Highway Patrol, St. Louis and Kansas City metropolitan police departments, and St. Louis County police department.



## 2.0 Truck Parking Analysis

### 2.1 Inventory/Supply

In order to identify areas where additional truck parking capacity or technologies may be needed, this study compares inventory (supply) against demand to identify gaps.

Supply consists of both publicly owned and privately owned designated truck parking sites. The publicly owned inventory was obtained from the Missouri Department of Transportation and includes a number of welcome centers, rest areas and truck parking-only facilities. The privately owned inventory is derived from several sources including:

- American Truck Parking;<sup>5</sup>
- AllStays;<sup>6</sup>
- Trucker Path;<sup>7</sup> and
- Google Earth/Map imagery.

Privately owned sites included in this inventory were limited to those that sell fuel and have a minimum of 10 spaces available for trucks to park. This limitation was implemented for two main reasons:

- Truck GPS sample data (used to calculate demand) is more accurate at larger facilities due to the increased chance that a representative number of trucks will park there during the sample periods.
- Inventory at non-fueling sites (particularly box stores, restaurants, hotels) is less predictable as supply can be dependent on day of the week or hour. In addition, permission to park trucks at these facilities can be withdrawn by the landowner/facility operator or can be subject to municipal regulations.

Finally, while all facilities that are complete as of March 2020 are included in this inventory section, only those complete as of February 2019 are part of the gap analysis. This is because truck GPS data from four two-week periods in 2019 is used to determine demand; including inventory completed during or after that time would skew the resulting analysis. Figure 2.1 provides an overview of the state's inventory.<sup>8</sup>

---

<sup>5</sup> <https://www.americantruckparking.com/>

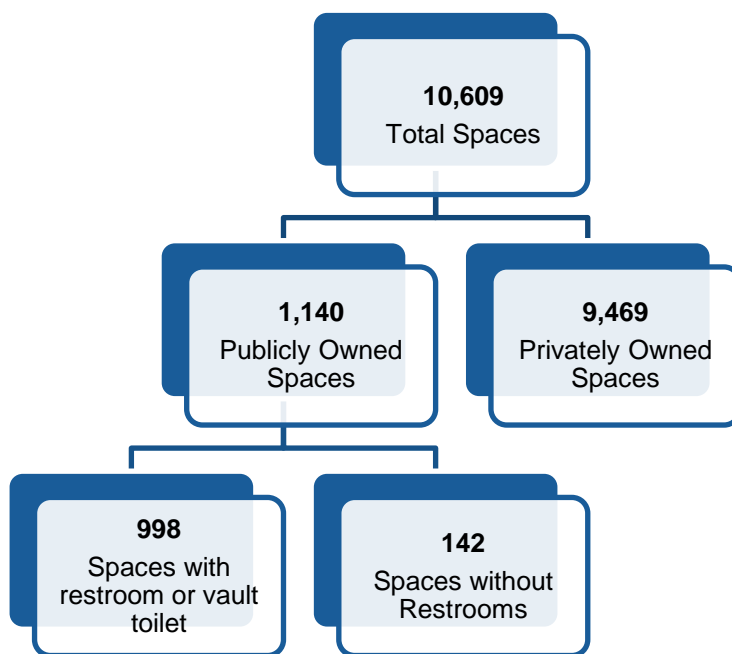
<sup>6</sup> <https://www.allstays.com/c/truck-stops-missouri.htm>

<sup>7</sup> <https://truckerpath.com/>

<sup>8</sup> Note that the Bloomsdale Weigh Station (I-55 in Ste. Genevieve County, Southeast District) will no longer allow truck parking after November 2020



FIGURE 2.1 OVERVIEW OF TRUCK PARKING IN MISSOURI



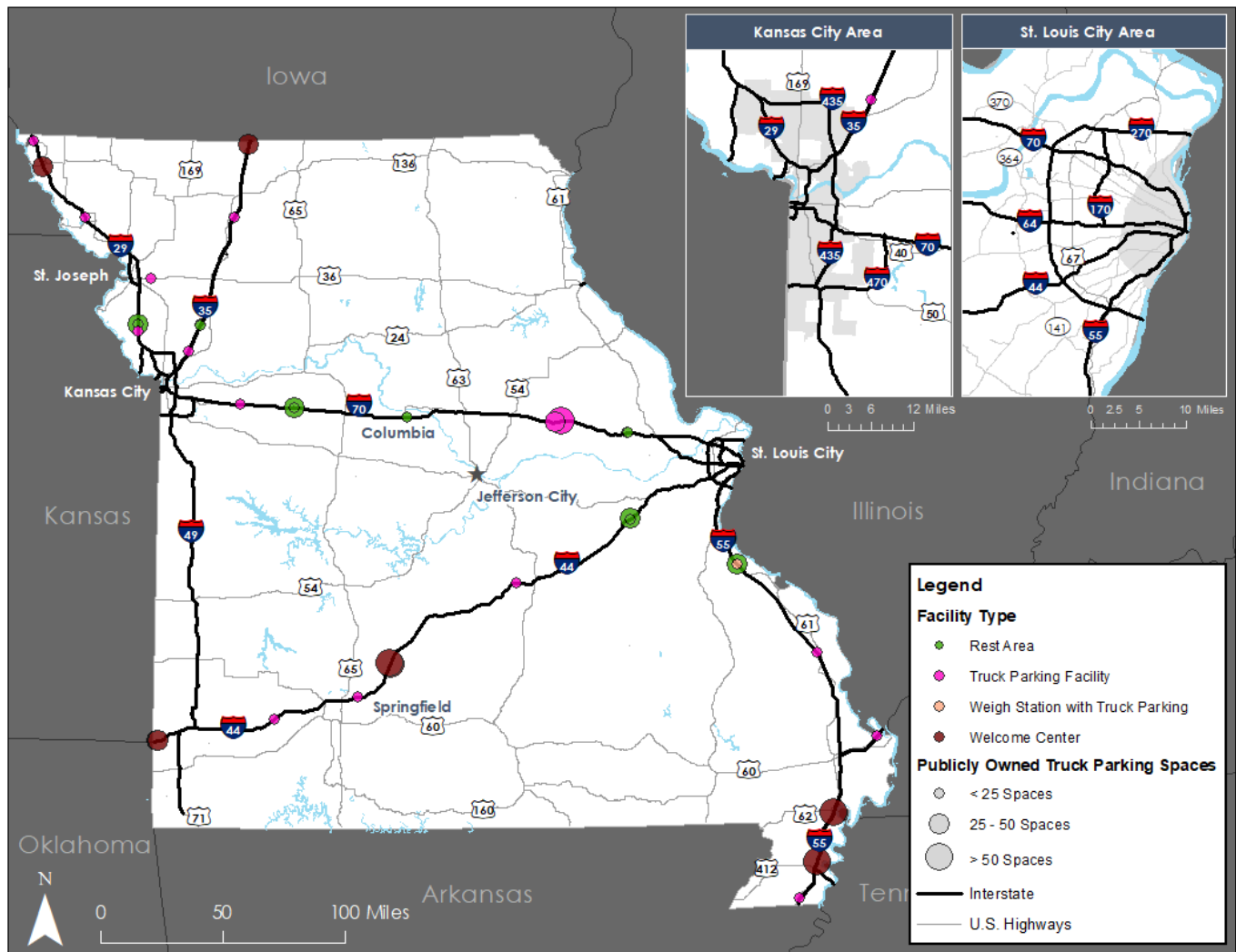
Source: MoDOT, Analysis by Cambridge Systematics (2020).

## Publicly Owned Inventory

There are approximately 1,140 publicly owned truck parking spaces spread across 46 sites in 24 counties and all seven MoDOT Districts. These spaces account for approximately 11% of the total inventory in the state. These sites are shown in Figure 2.2 and Table 2.1 provides an inventory by MoDOT District. The Conway Welcome Center on I-44 in Webster County is the largest publicly owned facility with 78 spaces in both the eastbound and westbound directions. The Marston Welcome Center (New Madrid County), Mineola Truck Parking Facility (Montgomery County) and Hayti Welcome Centers (Pemiscot County) also have more than 50 spaces each. All publicly owned facilities with the exception of St. Joseph Truck Parking Area on U.S. 36 with eight spaces (Buchanan County) are located on an interstate corridor.

Many of these facilities offer amenities to truck drivers as shown in Figure 2.3. All the Welcome Centers and Rest Areas offer vending machines and restrooms and most of the truck parking only facilities have vault toilets available. Most parking spaces are striped and offer angled parking which is easier and safer for drivers when parking and leaving. More information about the public site amenities is provided in the Site Profiles in Appendix A.

FIGURE 2.2 MISSOURI PUBLICLY OWNED TRUCK PARKING INVENTORY



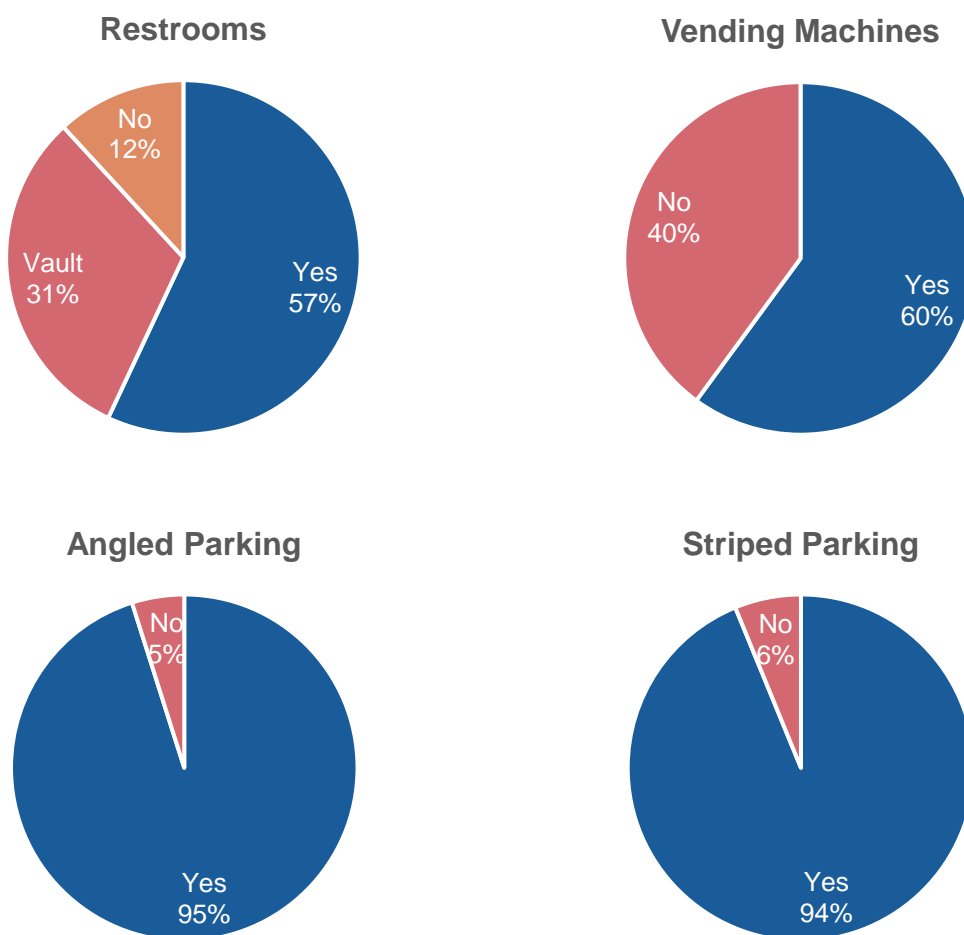
Source: MoDOT, Analysis by Cambridge Systematics (2020).

TABLE 2.1 PUBLICLY OWNED TRUCK PARKING INVENTORY BY MODOT DISTRICT

District	Number of Truck Parking Sites	Number of Truck Parking Spaces	Percent of Publicly Owned Truck Parking Inventory
Central	3	63	5.5%
Kansas City	8	150	13.2%
Northeast	4	131	11.5%
Northwest	11	202	17.7%
Southeast	10	263	23.1%
Southwest	7	281	24.6%
St. Louis	3	50	4.4%
<b>Total</b>	<b>46</b>	<b>1,140</b>	<b>100.0%</b>

Source: MoDOT, Analysis by Cambridge Systematics (2020).

FIGURE 2.3 AMENITIES AT PUBLICLY OWNED TRUCK PARKING SITES



Source: MoDOT, Analysis by Cambridge Systematics (2020).

## Privately Owned Inventory

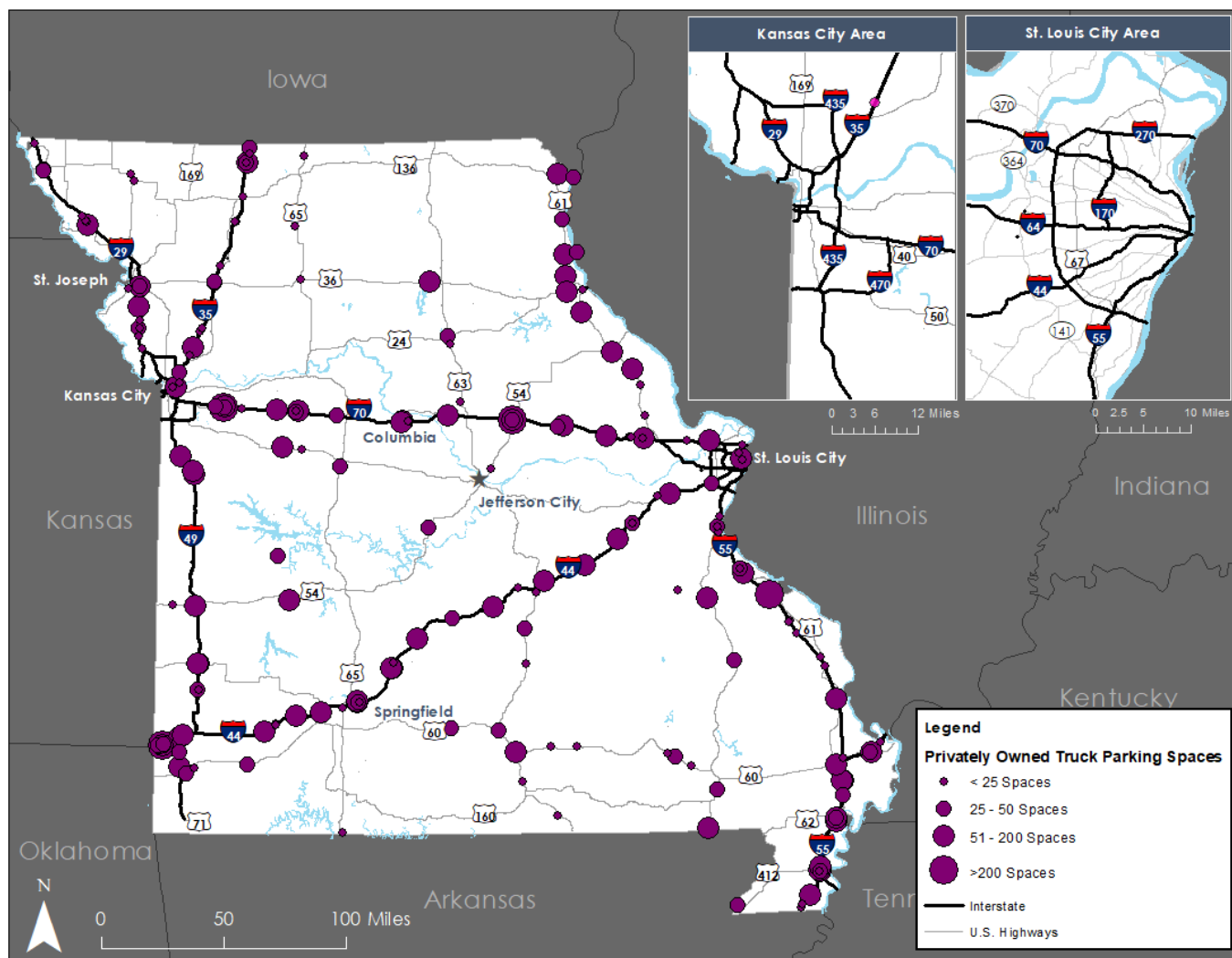
Privately owned truck parking provides approximately 89% of the total truck parking capacity in Missouri with approximately 9,469 spaces at 159 sites in 68 counties. Three of these, the Big Apple Travel Center in Joplin (Jasper County), Love's #783 in Willow Springs (Howell County) and Conoco Truck Plaza in Grain Valley (Jackson County) were under construction as of 2019. Their 200 total spaces are included in the inventory analysis presented here but are not part of the calculation of truck parking gaps in Section 2.3.

The largest facility is a Petro in Joplin (Newton County) with approximately 475 spaces followed by a Petro in Oak Grove (Jackson County) with just more than 300 spaces.

Missouri's privately owned truck parking inventory is shown in Figure 2.4 and Table 2.2 provides a breakdown of inventory by District. The majority of spaces, more than 7,400 of the nearly 9,500, are located within a mile of the interstate system. I-70, I-44 and I-55 all have more than 1,000 spaces along their length with U.S. 60 and U.S. 61 having the highest non-interstate inventories (390 and 240 spaces, respectively). There are some notable gaps along U.S. 60 east of Springfield and sections of U.S. 36. These two routes both carry an average of more than 5,000 trucks per day making them some of the highest travelled non-interstate corridors in the state. Although there may be a few smaller truck parking facilities not included in this inventory along those routes, these areas may have higher rates of unauthorized parking due to the distance between authorized parking sites.



FIGURE 2.4 MISSOURI PRIVATELY OWNED TRUCK PARKING INVENTORY



Source: MoDOT, Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

**TABLE 2.2 PRIVATELY OWNED TRUCK PARKING INVENTORY BY MODOT DISTRICT**

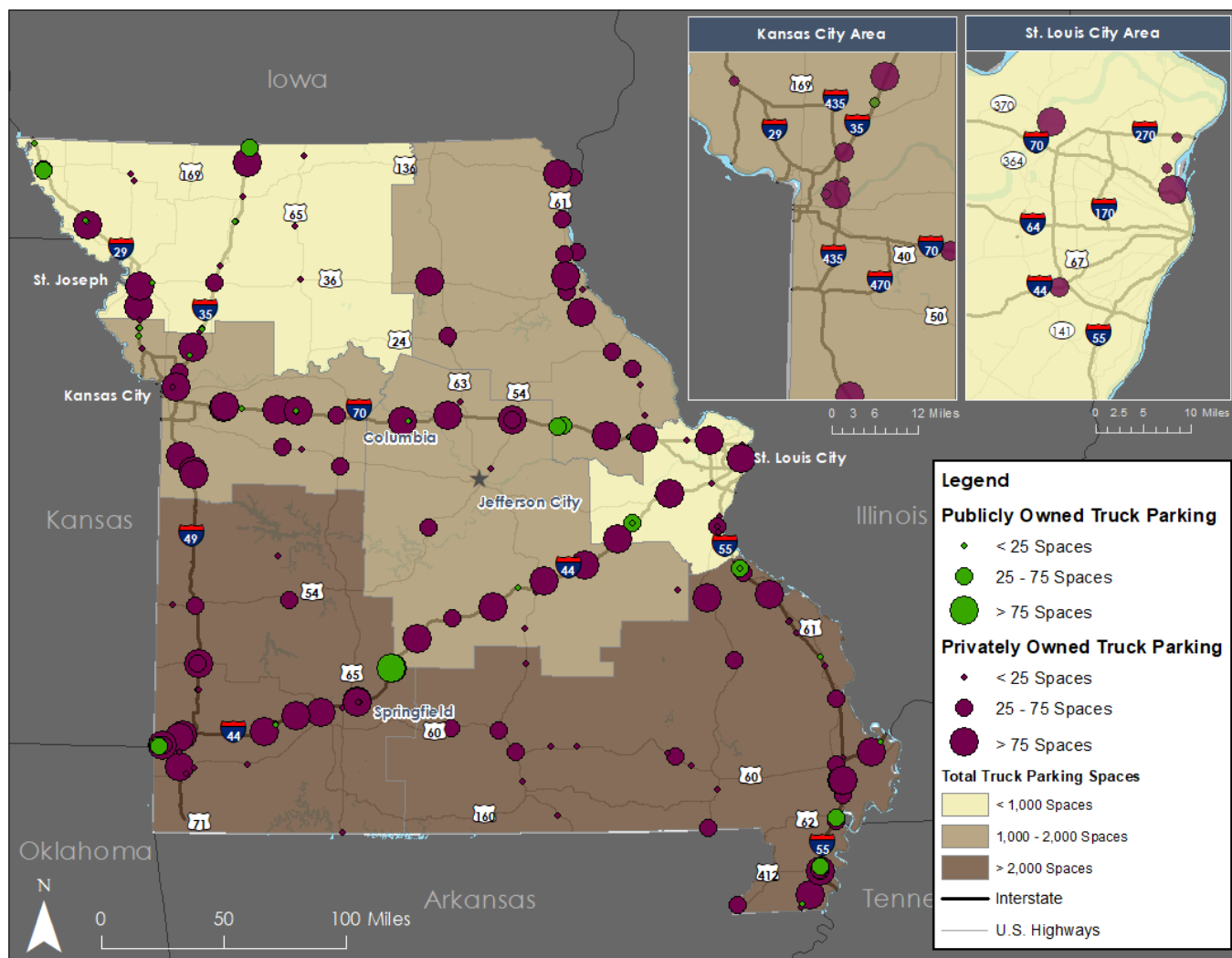
District	Number of Truck Parking Sites	Number of Truck Parking Spaces	Percent of Privately Owned Truck Parking Inventory
Central	18	1,298	13.7%
Kansas City	20	1,540	16.3%
Northeast	18	1,028	10.9%
Northwest	21	742	7.8%
Southeast	38	1,964	20.7%
Southwest	28	2,130	22.5%
St. Louis	16	767	8.1%
<b>Total</b>	<b>159</b>	<b>9,469</b>	<b>100.0%</b>

Source: MoDOT, Truck parking websites and applications. Analysis by Cambridge Systematics (2020). Errors due to rounding.

## Total Inventory

Figure 2.5 shows Missouri's total truck parking inventory as well as the number of spaces by MoDOT District. The Southeast and Southwest Districts have the highest number of truck parking spaces with over 2,000 each while the Northwest and St. Louis Districts have the lowest number with less than 1,000 total spaces. This information is summarized in Table 2.3.

FIGURE 2.5 MISSOURI TOTAL TRUCK PARKING INVENTORY



Source: MoDOT, Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

**TABLE 2.3 TOTAL TRUCK PARKING INVENTORY BY MODOT DISTRICT**

District	Number of Truck Parking Sites	Number of Truck Parking Spaces	Percent Truck Parking Inventory
Central	22	1,361	12.8%
Kansas City	28	1,690	15.9%
Northeast	22	1,159	10.9%
Northwest	32	944	8.9%
Southeast	48	2,227	21.0%
Southwest	35	2,411	22.7%
St. Louis	19	817	7.7%
<b>Grand Total</b>	<b>206</b>	<b>10,609</b>	<b>100.0%</b>

Source: MoDOT, Truck parking websites and applications. Analysis by Cambridge Systematics (2020). Errors due to rounding.

Parking inventory by interstate highway corridor is shown in Table 2.4. This table includes all facilities within a mile of an interstate. Note that some sites may be counted for more than one corridor when located near an interstate interchange.

**TABLE 2.4 TOTAL TRUCK PARKING INVENTORY BY INTERSTATE CORRIDOR (WITHIN 1 MILE)**

Interstate	Number of Truck Parking Sites	Number of Truck Parking Spaces (Publicly and Privately Owned)	Interstate Length (miles)	Truck Parking Spaces per Mile of Interstate
I-29	15	529	129	4.1
I-35	18	563	110	5.1
I-44	35	2,808	293	9.6
I-55	32	1,586	209	7.6
I-57	3	140	22	6.4
I-70	30	2,122	249	8.5
I-270	1	20	35	0.6

Source: MoDOT, Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

I-44 has the greatest concentration of parking spaces on a per-mile basis in Missouri, followed by I-70 and I-55. I-270 has the lowest concentration, likely due to its unique purpose compared to the other interstates listed as a loop highway in a heavily urban/suburban region around St. Louis. Higher land prices and land use/zoning restrictions likely contribute to the limited development of truck parking options.

## 2.2 Demand/Users

While truck parking is a potential concern statewide, this analysis focused on identifying issues along Missouri's interstate corridors as these routes carry the heaviest volumes of truck traffic.



## Data Overview

To understand demand, the team obtained truck GPS data within one-half mile of the interstate system from the American Transportation Research Institute. Data was obtained for four two-week periods as shown in Table 2.5.

**TABLE 2.5     ATRI DATA COLLECTION PERIODS**

	February	May	July	October	Total
Start Date	02/03/2019	05/05/2019	07/14/2019	10/15/2019	N/A
End Date	02/16/2019	05/18/2019	07/27/2019	10/28/2019	N/A
Number of Trucks	93,390	90,484	85,538	102,833	372,245
Number of GPS Points	63,668,851	55,581,330	51,794,389	54,698,135	225,742,705
<b>Processed Stops</b>	<b>124,798</b>	<b>117,829</b>	<b>114,380</b>	<b>121,321</b>	<b>478,328</b>

Source: ATRI. Analysis by Cambridge Systematics (2020).

These periods included at least two of each day of the week to account for weekday variations. Seasonal effects were captured by analyzing different months of the year. A process was then used to take the overall set of GPS “points” or pings obtained and identify stopped trucks with a minimal stop of 15 minutes. For additional information about processing steps, see Appendix B.

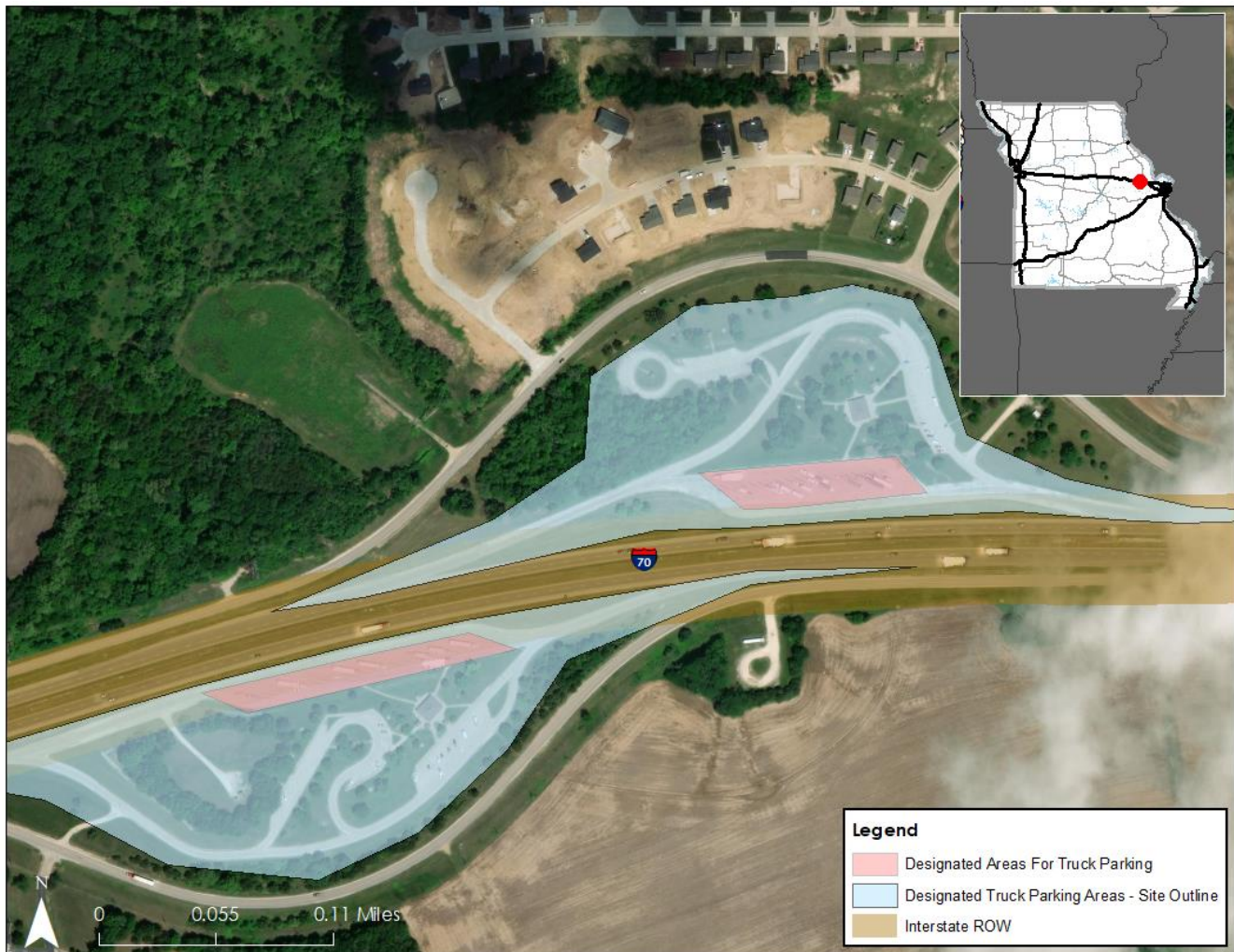
## Inventory Used for Demand and Gap Analysis

To identify trucks parked in designated areas, polygons were drawn around the designated truck parking sites within the same one-half mile of the interstate as the truck GPS data was captured. As a result, polygon shapes were drawn for 141 sites with 8,369 total spaces, representing 78.9% of the known inventory. This approach allows each location to “capture” the trucks parked in and around the site. Polygons were drawn slightly larger than the actual site to include entrance and exit ramps for rest areas or other public sites and driveways or dead-end streets around private sites. This approach is valuable because trucks parked just outside designated parking sites are assumed to prefer to park in the actual location but cannot find available space. Therefore, they are part of the site demand even though they are actually parked outside the designated area.

In addition, right of way polygon shape files were obtained from MoDOT to identify trucks parked on the highway shoulders and ramps.

Figure 2.6 provides an example using the Wright City Rest Area on I-70 with the designated parking area for trucks outlined in red, the area used to determine site demand outlined in light blue and the interstate ROW in brown.

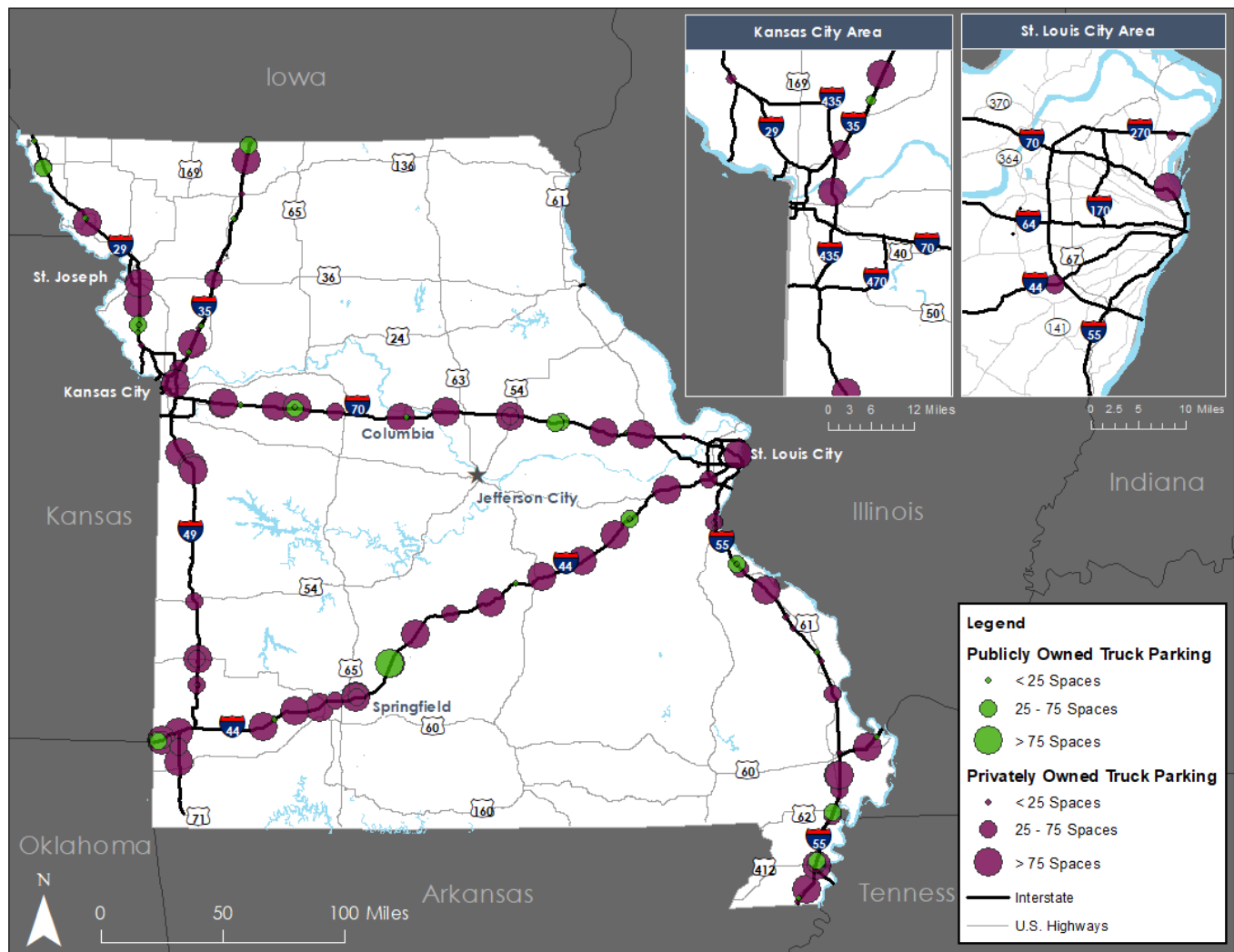
**FIGURE 2.6 TRUCK PARKING POLYGON EXAMPLE – WRIGHT CITY REST AREA AND INTERSTATE ROW**



Source: MoDOT. Analysis by Cambridge Systematics (2020).

The sites included in the gap analysis are shown in Figure 2.7 below and summarized in Table 2.6.

FIGURE 2.7 TRUCK PARKING INVENTORY INCLUDED IN GAP ANALYSIS



Source: MoDOT, Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

**TABLE 2.6 TRUCK PARKING INVENTORY INCLUDED IN GAP ANALYSIS**

District	Number of Publicly Owned Truck Parking Sites (% of total facilities)	Number of Publicly Owned Truck Parking Spaces (% of total spaces)	Number of Privately Owned Truck Parking Sites (% of total facilities)	Number of Privately Owned Truck Parking Spaces (% of total spaces)
Central	3 (2%)	63 (1%)	12 (8%)	1,183 (16%)
Kansas City	8 (6%)	150 (2%)	14 (10%)	1,380 (19%)
Northeast	4 (3%)	131 (2%)	2 (1%)	191 (2%)
Northwest	10 (7%)	194 (2%)	15 (11%)	675 (8%)
Southeast	10 (7%)	263 (3%)	21 (15%)	1,370 (16%)
Southwest	7 (5%)	281 (3%)	18 (13%)	1,775 (21%)
St. Louis	3 (2%)	50 (1%)	14 (10%)	663 (8%)
<b>Total</b>	<b>45 (32%)</b>	<b>1,132 (14%)</b>	<b>96 (68%)</b>	<b>7,237 (86%)</b>

Source: MoDOT. Truck parking websites. Analysis by Cambridge Systematics (2020). Note: Errors due to rounding.

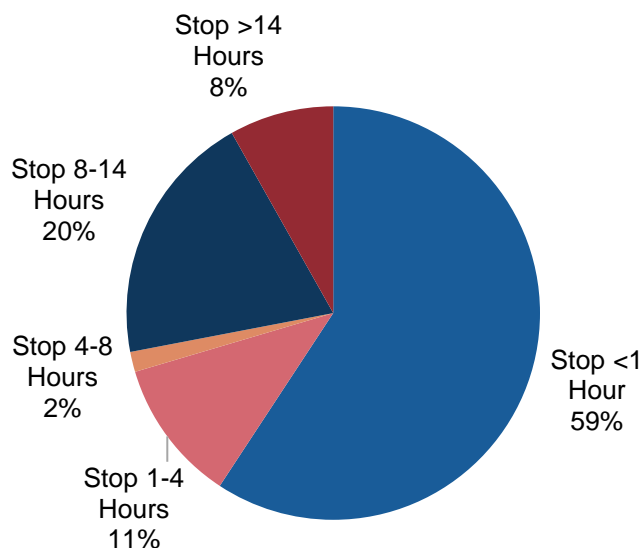
## Raw Demand Results

Slightly more than 478,000 “raw” stops are included in the analysis. Of these stops, approximately 96.5% are in one of the 142 designated truck parking sites within one-half mile of the interstates, with more than 16,500 stops located on interstate ROW. Figure 2.8 shows the overall breakdown of stops for designated parking sites and interstate ROW. The majority of stops in both sets of locations lasted for less than one hour (59% in designated sites, 64% on the interstate ROW). The second highest category within designated areas are stops lasting between eight and 14 hours—these are most likely “overnight” stops of a minimum of 10 hours to meet the HOS requirement. On interstates, the second highest category are stops lasting between one and four hours which may be more related to staging stops near pickup and delivery locations.

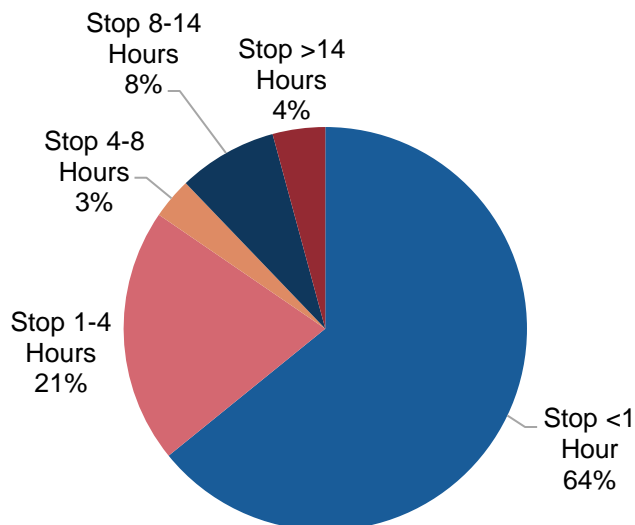
Figure 2.9 shows the different length of stays for trucks stopped in publicly owned versus privately owned designated truck parking sites. Although very similar, privately owned sites see a higher percent of long duration stops (more than 14 hours), likely due to the amenities provided at many of these facilities such as showers, expanded food options and fuel.

FIGURE 2.8 MISSOURI – DURATION OF TRUCK STOP BY STOP LOCATION

**Stops in Designated Parking Areas**



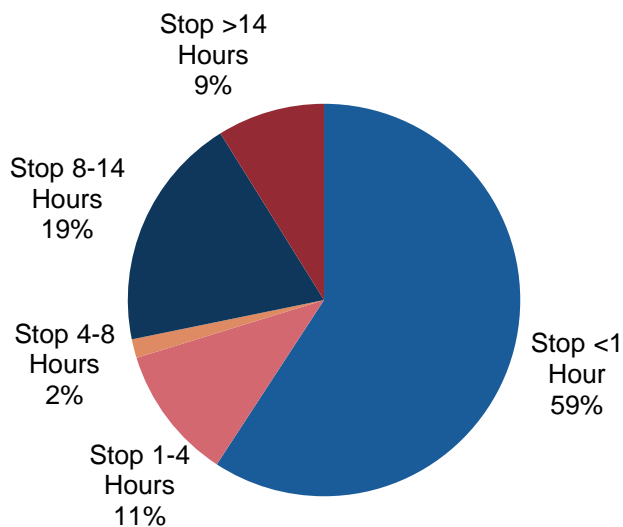
**Stops on Interstate ROW**



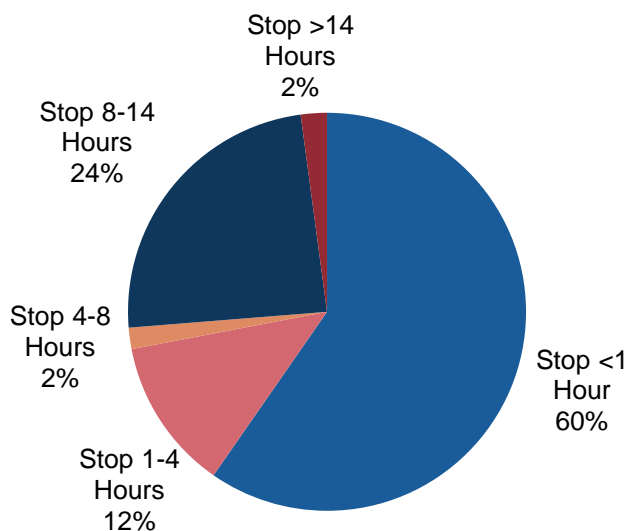
Source: ATRI. Analysis by Cambridge Systematics (2020).

FIGURE 2.9 MISSOURI – DURATION OF STOP BY PUBLIC OR PRIVATE DESIGNATED TRUCK STOP

**Stops in Privately Owned Designated Parking Areas**



**Stops in Publicly Owned Designated Parking Areas**



Source: ATRI. Analysis by Cambridge Systematics (2020).



## 2.3 Gap Analysis

### Developing Expansion Factors

The above steps provide a “raw” set of data about truck stops within one-half mile of the interstates. However, ATRI GPS data does not capture every truck on the road. Because of this limitation, expansion factors must be developed to compare the number of trucks in the ATRI data to the total number of trucks passing a point as captured by Missouri weigh-in-motion systems. ATRI data mostly consists of larger trucks (FHWA Class 8 or above), so MoDOT Class 8 and above (see Figure 2.10) truck counts were obtained to provide the comparison.<sup>9</sup>

The six locations used to obtain this comparison are shown in Figure 2.11.<sup>10</sup> These locations were chosen to obtain a geographic balance across the state and include counts from both urban and rural areas. Depending on the day and site, ATRI captured between 9.2% and 42.5% of the total Class 8 and above traffic at these locations. Overall, across all locations and days, ATRI captured an average of 24.8% of the total traffic. This means that each “raw” stop in the ATRI GPS data is multiplied by an expansion factor of 4.03 to represent the additional trucks operating in Missouri not captured in the GPS information.<sup>11</sup> By using an expansion factor, the difference between supply (inventory) and demand can be calculated.




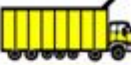












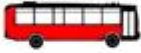













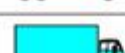



---

<sup>9</sup> Note that smaller box trucks are generally not included in the analysis. These trucks mostly operate regionally and do not generate the same demand for truck parking (for overnight stops and staging) as do larger trucks traveling longer distances between stops.

<sup>10</sup> Counts were obtained for both directions of travel at each location. Any days where data from MoDOT was missing were discounted from the final calculations. Of the 336 possible data points (14 days X 4 periods X 6 counters), 324 (96%) were ultimately used to calculate the expansion factor.

<sup>11</sup> Using a 95% confidence level, the range of ATRI capture is between 24.3% and 25.3%. This leads to a low expansion factor of 3.95 and a high expansion factor of 4.12.

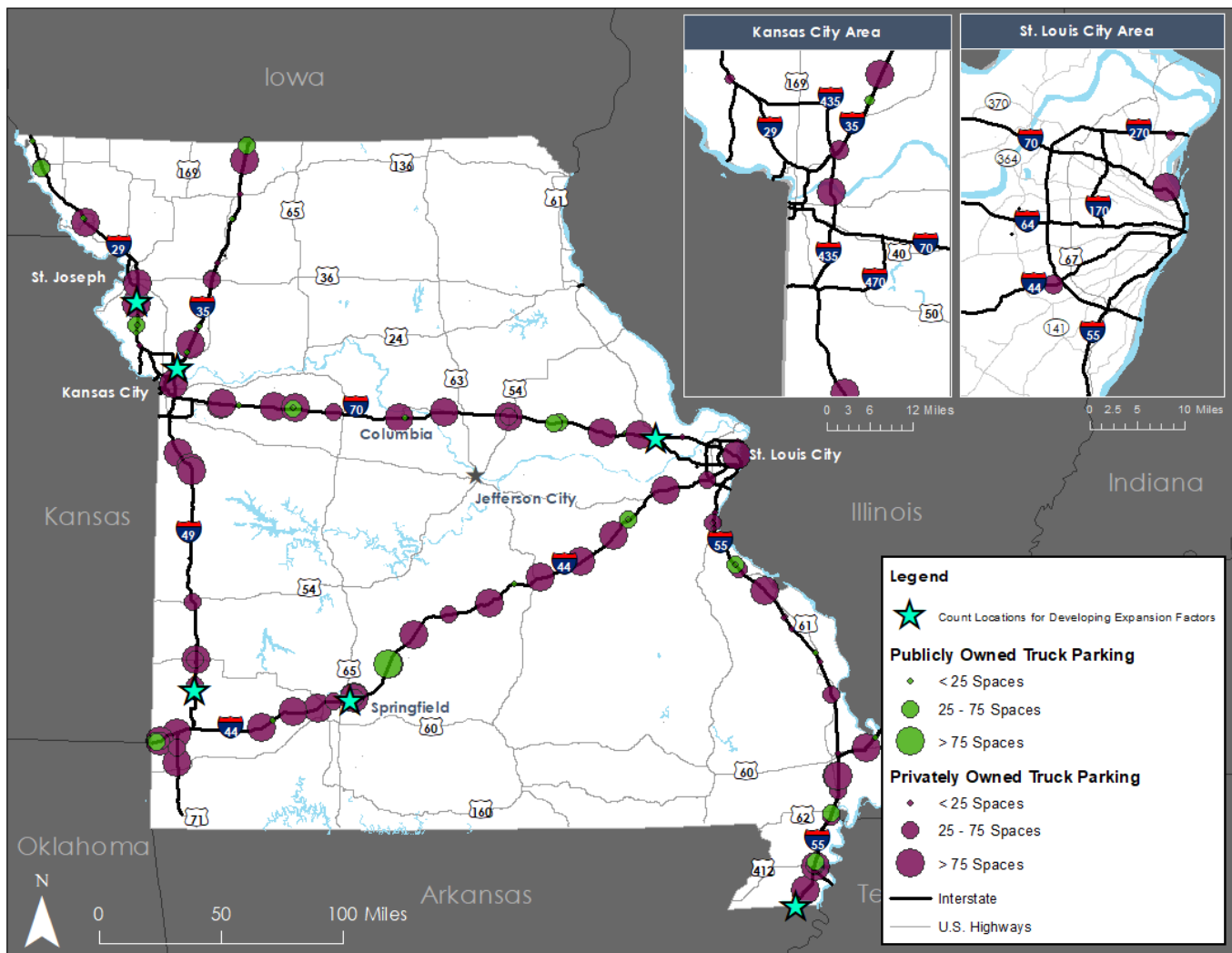
FIGURE 2.10 FHWA VEHICLE CLASSES

<b>Class 1</b> Motorcycles		<b>Class 7</b> Four or more axle, single unit	
<b>Class 2</b> Passenger cars		<b>Class 8</b> Four or less axle, single trailer	
			
			
			
<b>Class 3</b> Four tire, single unit		<b>Class 9</b> 5-Axle tractor semitrailer	
			
			
<b>Class 4</b> Buses		<b>Class 10</b> Six or more axle, single trailer	
			
		<b>Class 11</b> Five or less axle, multi trailer	
<b>Class 5</b> Two axle, six tire, single unit		<b>Class 12</b> Six axle, multi-trailer	
			
		<b>Class 13</b> Seven or more axle, multi-trailer	
<b>Class 6</b> Three axle, single unit			
			
			

Source: [https://www.fhwa.dot.gov/policyinformation/tmguid/tmg\\_2013/vehicle-types.cfm](https://www.fhwa.dot.gov/policyinformation/tmguid/tmg_2013/vehicle-types.cfm)



FIGURE 2.11 LOCATIONS FOR EXPANSION FACTOR CALCULATION AND TRUCK PARKING INVENTORY



Source: MoDOT. Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

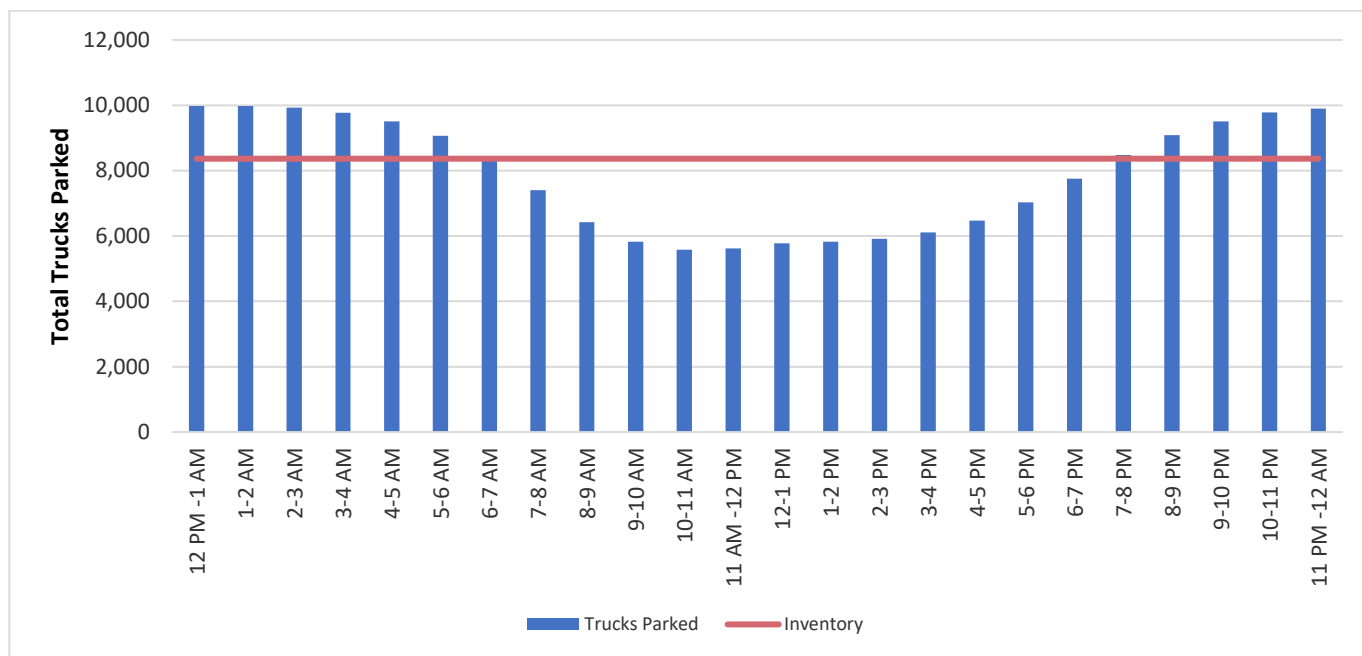
## Gap Analysis – Designated Parking Sites

Based on the expanded data and averaged across 56 days, there are an average of 33,220 stops occurring each day at the 141 designated truck parking sites located within one-half mile of the interstate system in Missouri. However, demand is not steady throughout the day. Some of those stops are short breaks of 30 minutes, some are stops of an hour or two to wait for a delivery appointment or for traffic or weather to clear, while some are longer stops to rest during an extended journey.

Figure 2.12 shows the overall distribution of stops by hour of the day. The highest demand for truck parking spaces is during the overnight hours with lower overall demand during the day (after 7 a.m. and before 7 p.m.). During the day, trucks are more likely to stop for shorter periods and so a single space can be used by multiple trucks. The midnight – 1 a.m. period has the highest systemwide total demand for truck parking spaces with an average of 9,981 stops per day. While individual sites experienced their peak demand at different hours of the day, the most

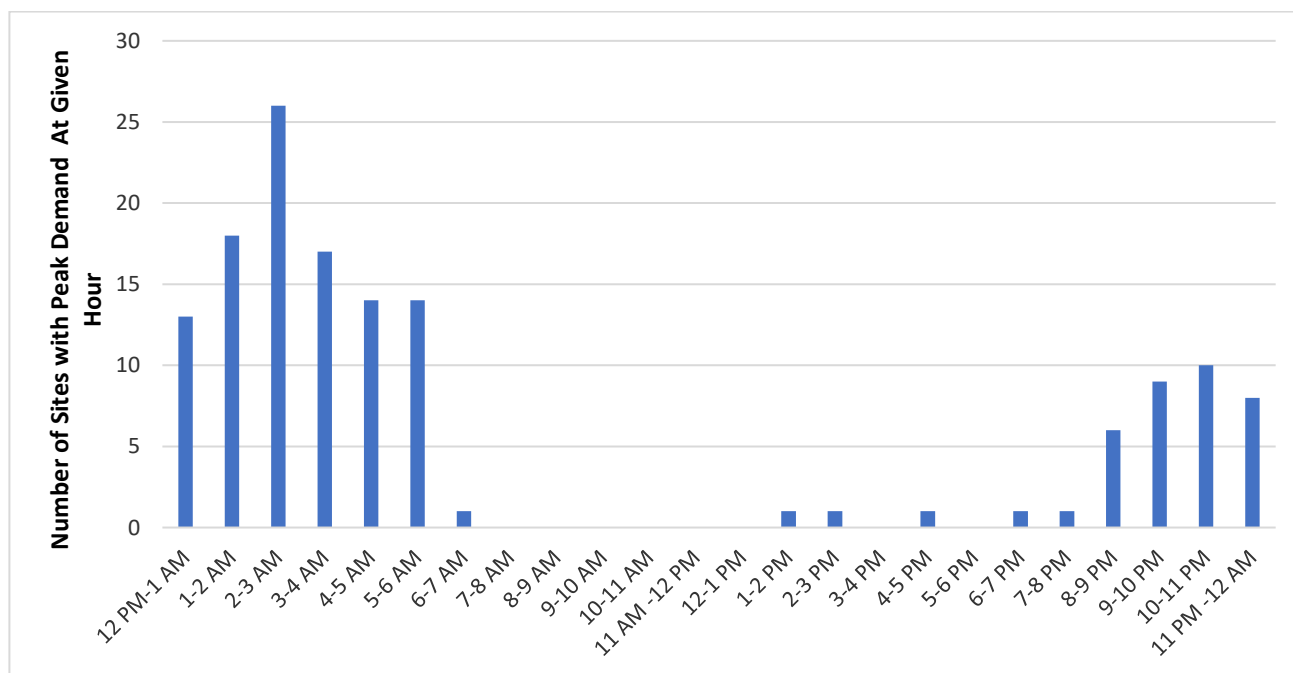
common period of peak demand was between 2 and 3 a.m. (26 sites) as shown in Figure 2.13. This time (2 - 3 a.m.) is used as the peak hour for the remainder of this analysis.

**FIGURE 2.12 TRUCK PARKING DEMAND AT DESIGNATED SITES BY TIME OF DAY**



Source: ATRI. Analysis by Cambridge Systematics (2020).

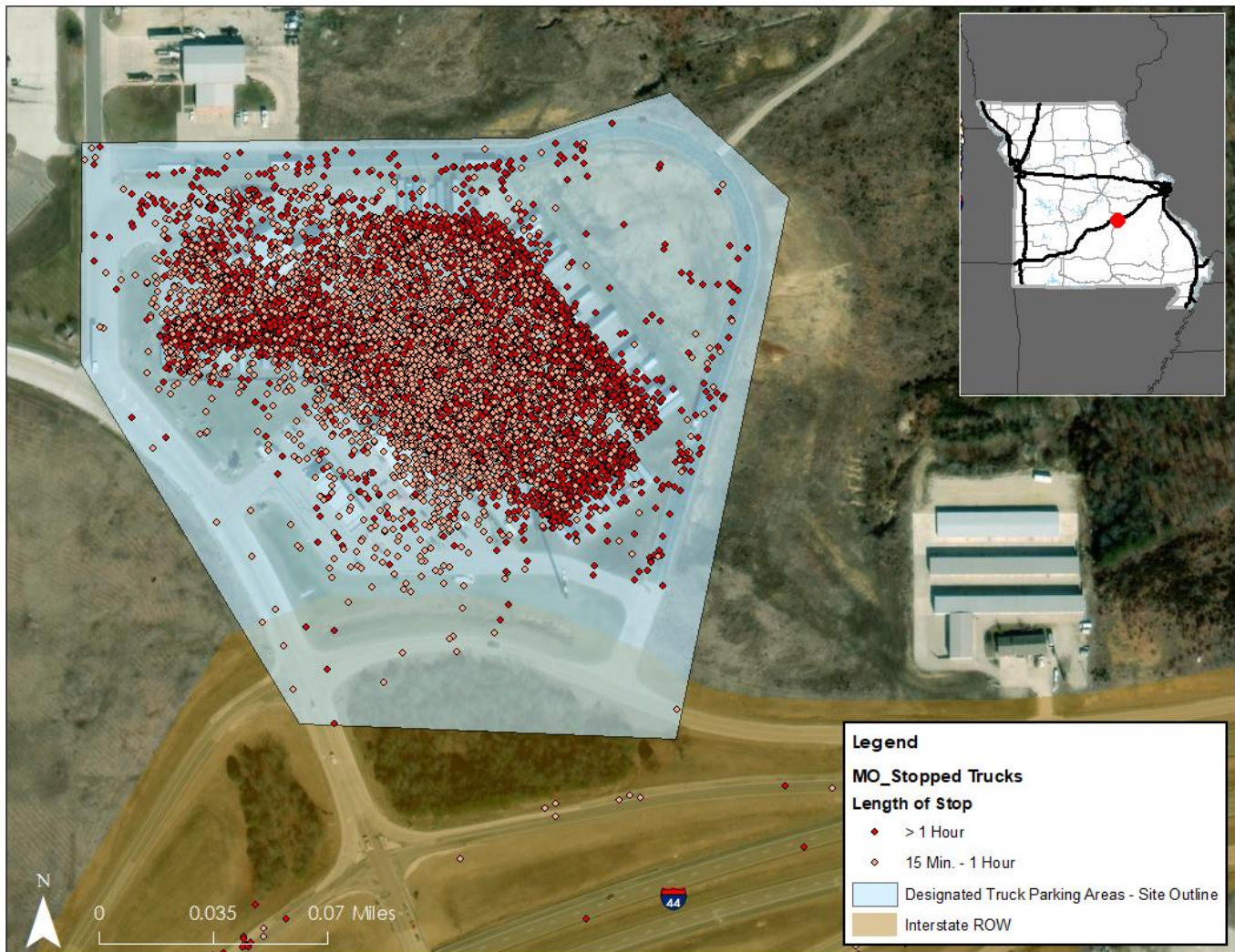
**FIGURE 2.13 TIME OF PEAK DEMAND AT DESIGNATED TRUCK PARKING SITES**



Source: ATRI. Analysis by Cambridge Systematics (2020).

Based on the peak hour (2 – 3 a.m.), 87 of the 141 designated sites (62%) are at or over capacity with demand in and around those sites exceeding capacity by a total of more than 2,300 spaces. This overage means that there are a substantial number of trucks that are parking on driveways, ramps, or along curbs or in car parking areas within or adjacent to these facilities. As an example, Figure 2.14 shows all GPS returns over the eight-week data period for trucks stopped at Love's #341 located on I-44 in Phelps County. This site has 89 truck parking spaces and a gap of more than 100 spaces between 2 and 3 a.m., the largest gap in the state at that hour.

**FIGURE 2.14 LOVE'S 341 – PARKED TRUCKS EXAMPLE**

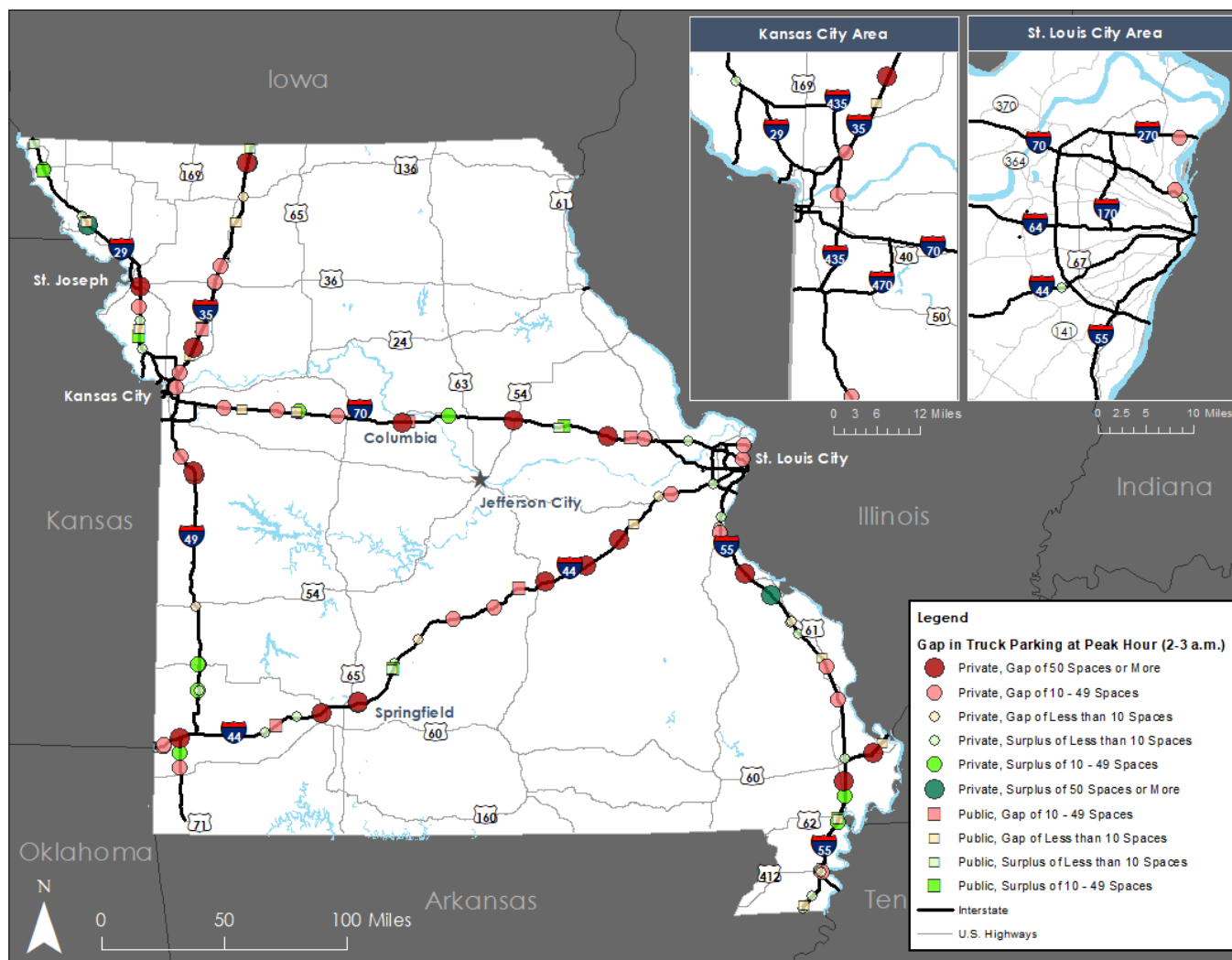


Source: ATRI. Analysis by Cambridge Systematics (2020).

Figure 2.15 shows the gap at publicly owned and privately owned designated truck parking sites the peak hour. Of the 87 sites at or over capacity at the peak hour, 61 (of 96 total) are privately owned and 26 (of 46 total) are publicly owned. The 35 sites with the greatest gap are all privately owned, with Wright City Rest Area on I-70 in Warren County having the 36<sup>th</sup> largest gap and highest of any publicly owned site (20 spaces). While over capacity sites exist statewide, clusters are found on I-35 northeast of Kansas City, most of I-44, I-70 west of I-270 and near the I-

55/I-57 interchange. Appendix A includes site profiles for the publicly owned truck parking sites with key attributes, utilization graphs and a site aerial showing where trucks parked during the eight-week data collection period.

**FIGURE 2.15 MISSOURI TRUCK PARKING GAP AT DESIGNATED PARKING SITES WITHIN ½ MILE OF THE INTERSTATES**



Source: ATRI. Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

Table 2.7 and Figure 2.16 show the inventory, demand and gap at designated sites during the peak hour (2 - 3 a.m.), aggregated to the MoDOT Districts. While every district is experiencing a shortage, the largest gap occurs in the Central District, with a shortage of nearly 500 spaces during the peak hour. The Kansas City, St. Louis and Southwest Districts have shortages of more than 200 spaces each.

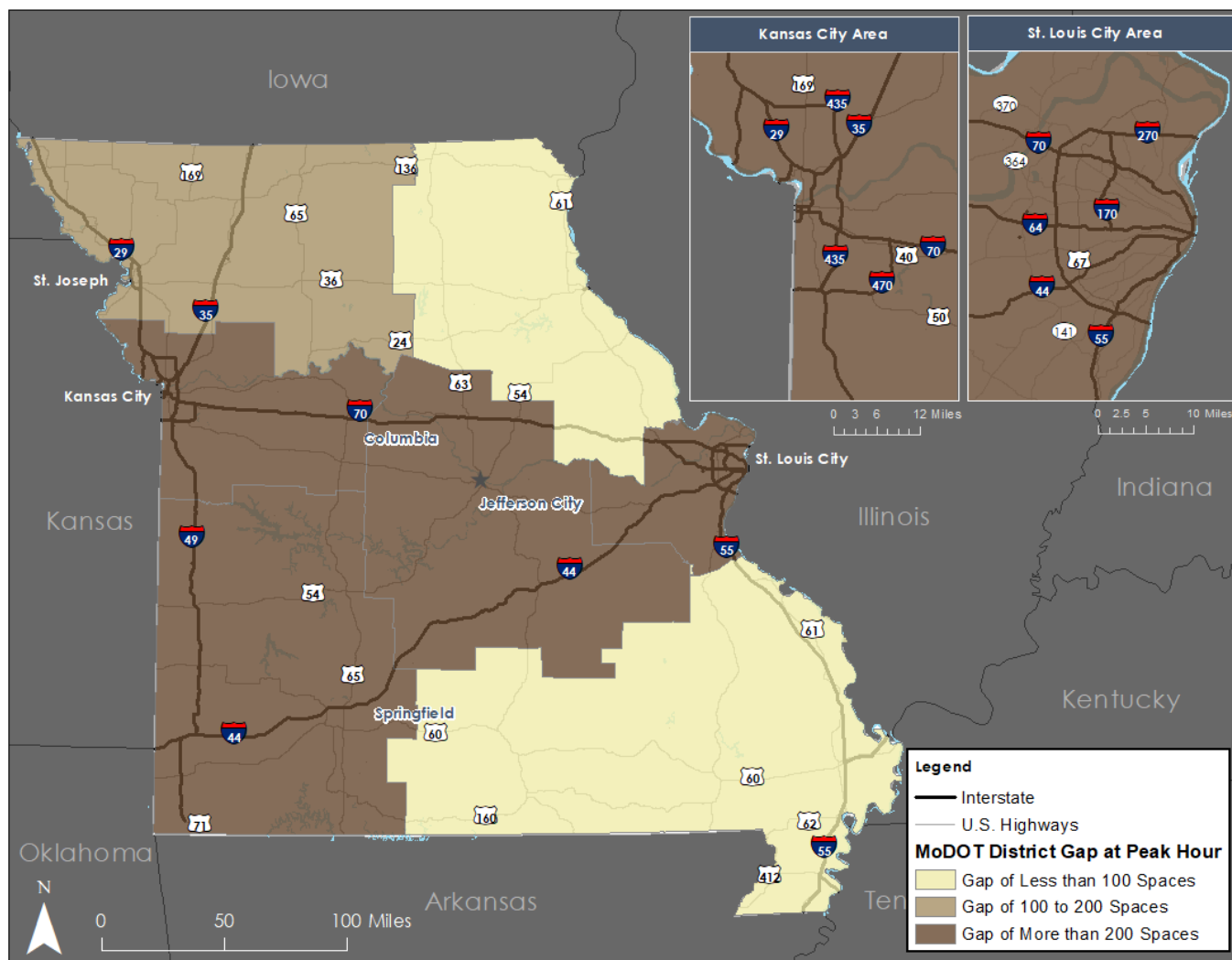


TABLE 2.7 TRUCK PARKING INVENTORY AND GAP BY DISTRICT

District	Number of Publicly Owned Truck Parking Spaces	Number of Privately Owned Truck Parking Spaces	Total Inventory	Total Demand at Designated Sites at Peak Hour (2 - 3 a.m.)	Gap at Peak Hour (2 - 3 a.m.)
Central	63	1,183	1,246	1,734	-488
Kansas City	150	1,380	1,530	1,869	-339
Northeast	131	191	322	386	-64
Northwest	194	675	869	985	-116
Southeast	263	1,370	1,633	1,678	-45
Southwest	281	1,775	2,056	2,353	-297
St. Louis	50	663	713	921	-208
<b>Total</b>	<b>1,132</b>	<b>7,237</b>	<b>8,369</b>	<b>9,926</b>	<b>-1,557</b>

Source: MoDOT. Truck parking websites. Analysis by Cambridge Systematics (2020). Note: Errors due to rounding.

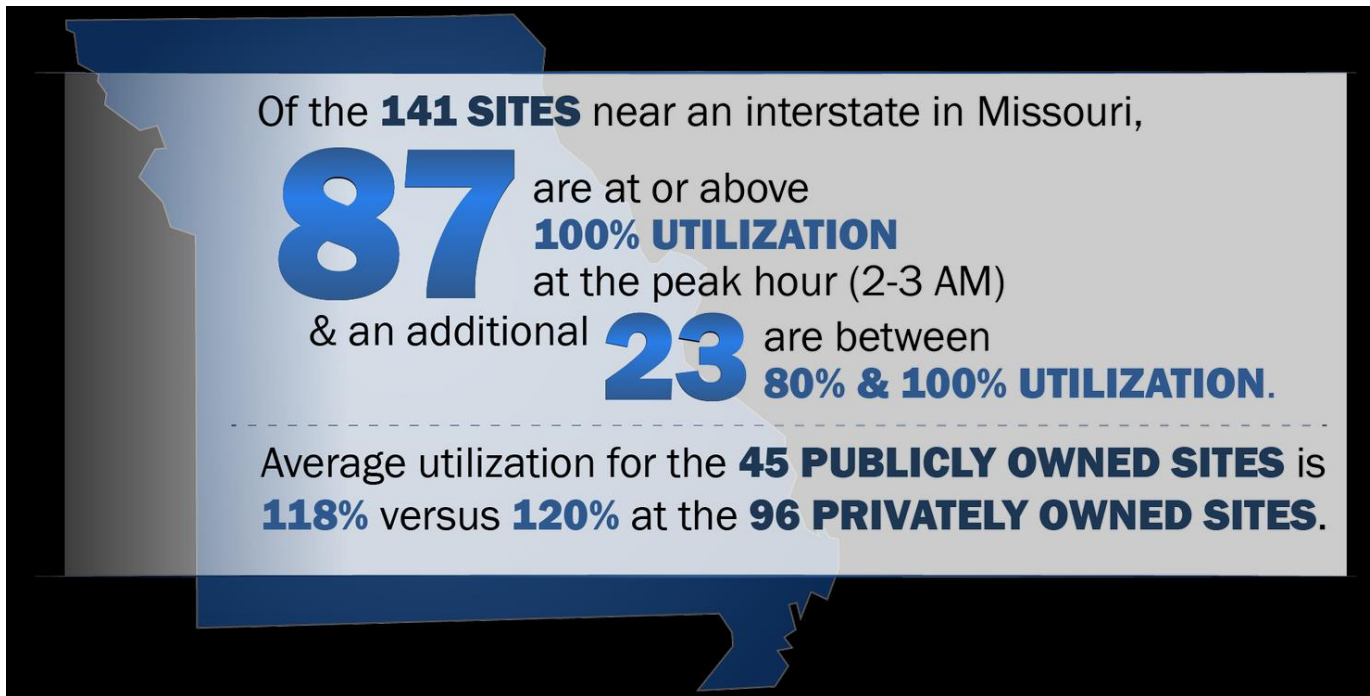
FIGURE 2.16 GAP AT PEAK HOUR BY MODOT DISTRICT



Source: ATRI. Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

A slightly different way to look at the gap analysis is to calculate site utilization which, rather than the absolute difference between the demand for parking at the peak hour and the number of spaces, uses the demand divided by the number of spaces. Using this approach, the average utilization rate at the peak hour is 120%, ranging from a low of 21% at a truck stop in Eagleville in Harrison County to a high of 287% at a Jones Travel Mart Oasis on I-35 in Cameron (DeKalb County). Of the 141 sites, 87 are at or above 100% utilization at the peak hour and an additional 23 are between 80% and 100% (see Figure 2.17). This category is important, as these sites represent “nearly full” locations which in reality may fill up on any given night. For example, the Conway Welcome Center (I-44 in Webster County) has an average surplus of 11 spaces at the peak hour but is still reaching 86% capacity. Figure 2.18 shows the utilization category for these publicly owned and privately owned designated parking sites. The story is very similar to the gap analysis, with much of I-44 east of Springfield, almost all of I-35 and large portions of I-70 and I-55 showing heavy utilization.

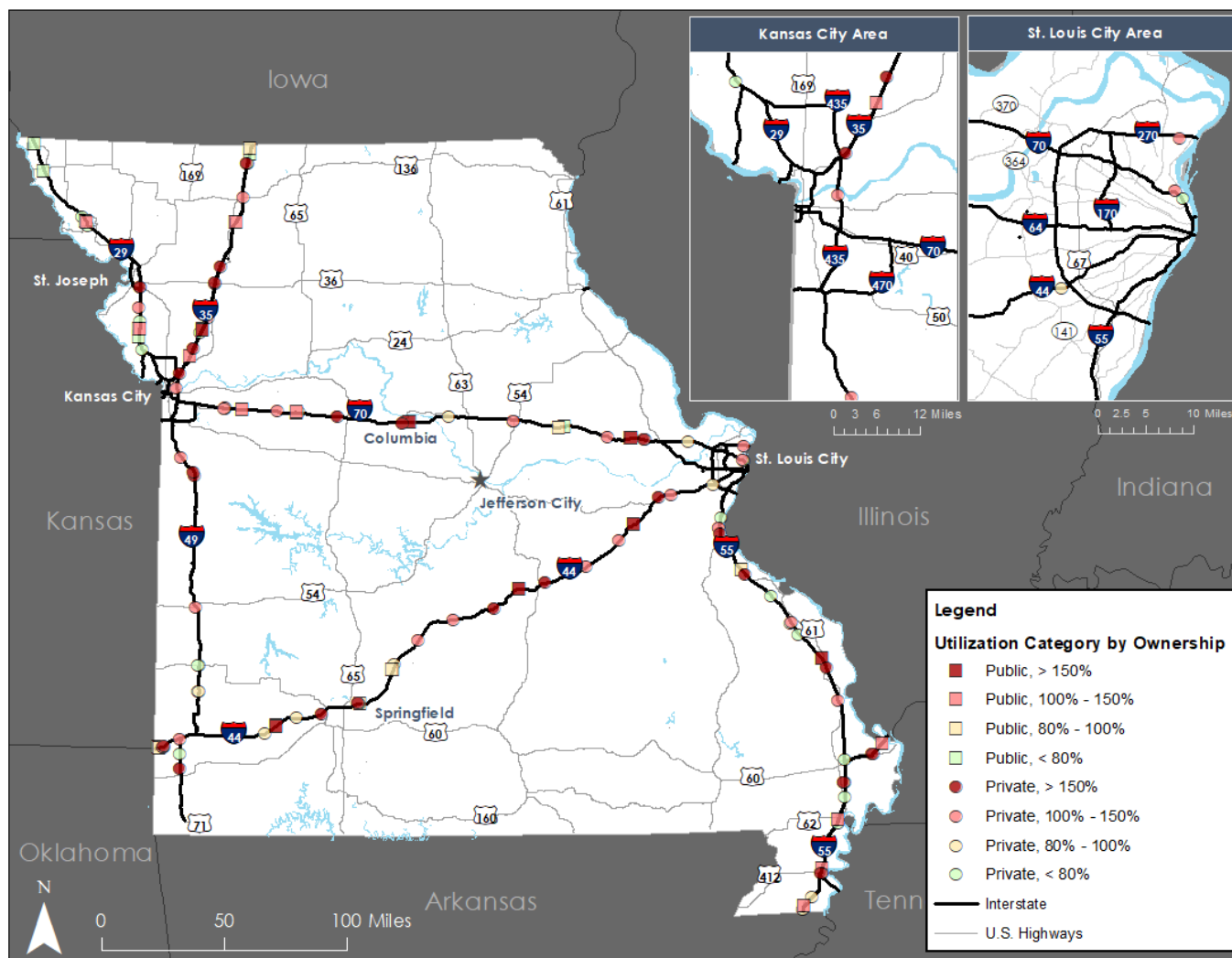
FIGURE 2.17 TRUCK PARKING UTILIZATION INFOGRAPHIC



The average utilization for the 45 publicly owned sites (118%) is slightly below the average utilization at the 96 privately owned sites (121%), but the relative parity indicates that drivers are using both during the overnight peak hour.



FIGURE 2.18 SITE UTILIZATION CATEGORY BY OWNERSHIP



Source: ATRI. Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

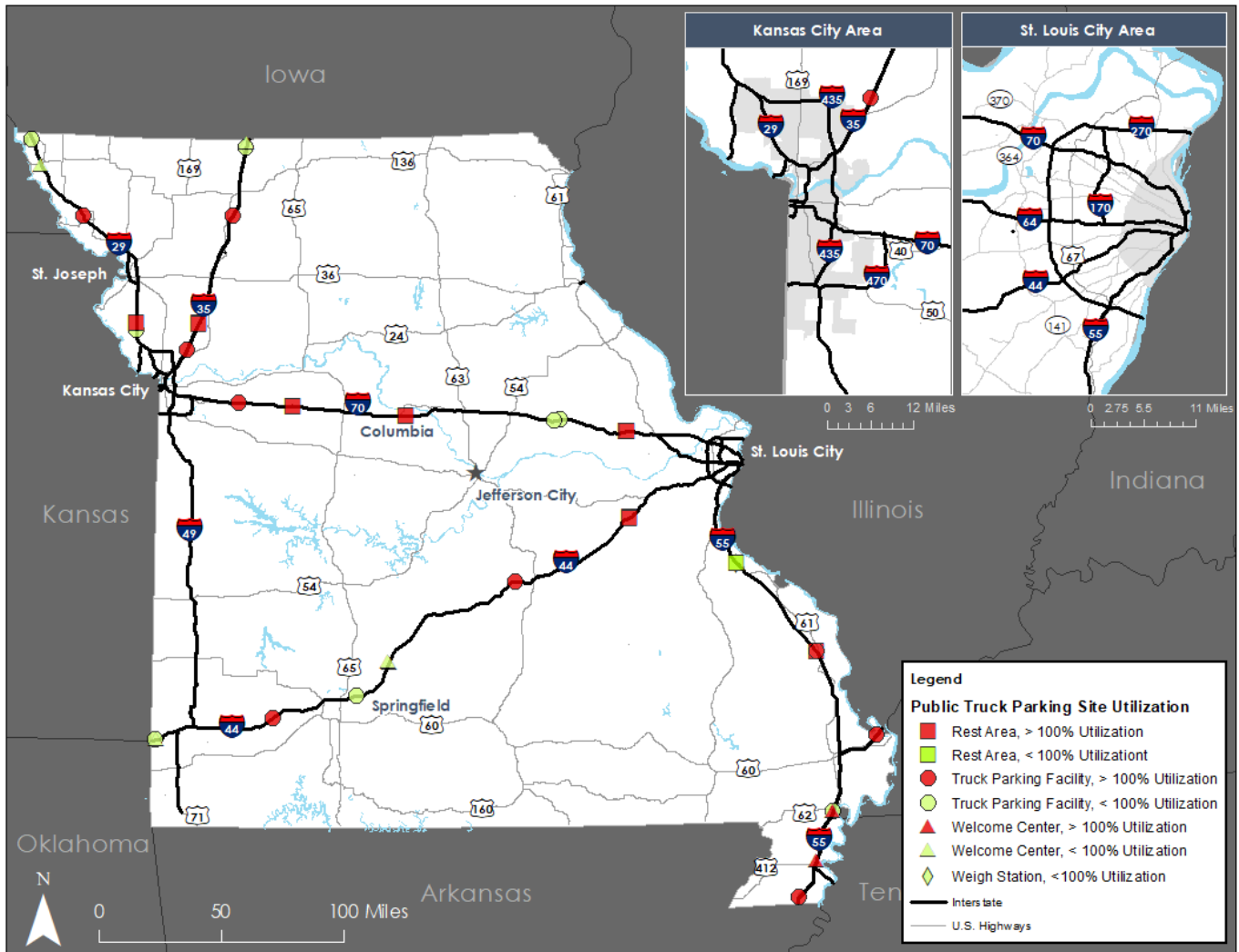
### Utilization at Publicly Owned Sites

Four categories of publicly owned sites were identified in consultation with MoDOT. These include:

- Seven Welcome Centers with 401 truck parking spaces;
- 14 Rest Areas with 281 truck parking spaces;
- 23 Truck Parking Only Facilities with 435 truck parking spaces; and
- One Weigh Station with 15 truck parking spaces.

Figure 2.19 shows utilization during the peak hour (2 - 3 a.m.) at these facilities and distinguishes them by type.

**FIGURE 2.19 MISSOURI TRUCK PARKING UTILIZATION AT PUBLICLY OWNED DESIGNATED PARKING SITES WITHIN ONE-HALF MILE OF THE INTERSTATES**



Source: ATRI. Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

In total, the rest areas had a gap of approximately 104 spaces and an average utilization rate of 147%, the truck parking facilities had a gap of 7 spaces and an average utilization rate of 111%, the weigh station had a surplus of five spaces and a utilization rate of 67% and the welcome centers had a surplus of 30 spaces and an average utilization rate of 91%. However, there was a great deal of variation within specific sites. For example, the nine truck parking facilities without restrooms or vault toilets<sup>12</sup> had a surplus of 18 spaces at the peak hour, indicating a much higher demand for the 21 sites with a full restroom (gap of 61 spaces) or the 15 sites with a vault toilet (gap of 34 spaces).

<sup>12</sup> Bloomsdale Weigh Station/Truck Parking (I-55 SB), Charleston (I-57 NB), Eagleville (I-35 NB), Kearney (I-35 SB), Odessa (I-70 EB/WB), Platte City (I-29 SB), Strafford (I-44 EB), Watson (I-29 NB).

The top 10 publicly owned sites by utilization rate at the peak hour (demand/inventory) include:

- **Lathrop Rest Area (I-35 NB) – 239% utilization**
- **Wright City Rest Area (I-70 WB) – 213% utilization**
- **Doolittle Truck Parking Facility (I-44 EB) – 209% utilization**
- **Doolittle Truck Parking Facility (I-44 WB) – 196% utilization**
- **Lathrop Rest Area (I-35 SB) – 191% utilization**
- **Halltown Truck Parking Facility (I-44 EB) – 164% utilization**
- **Boonville Truck Parking Facility (I-70 WB) – 161% utilization**
- **Wright City Rest Area (I-70 EB) – 160% utilization**
- St. Clair Rest Area (I-44 EB) – 159% utilization
- Fruitland Truck Parking Facility (I-55 NB) – 154% utilization

Sites in **bold** are also amongst the top 10 highest in terms of the gap (demand – inventory) at peak hour, with Boonville Rest Area (I-70 EB) and St. Clair Rest Area (I-44 WB) replacing St. Clair Rest Area (I-44 EB) and Fruitland Truck Parking Facility (I-55 NB) in the top 10. Profiles for all publicly owned sites in the State are included in Appendix A.

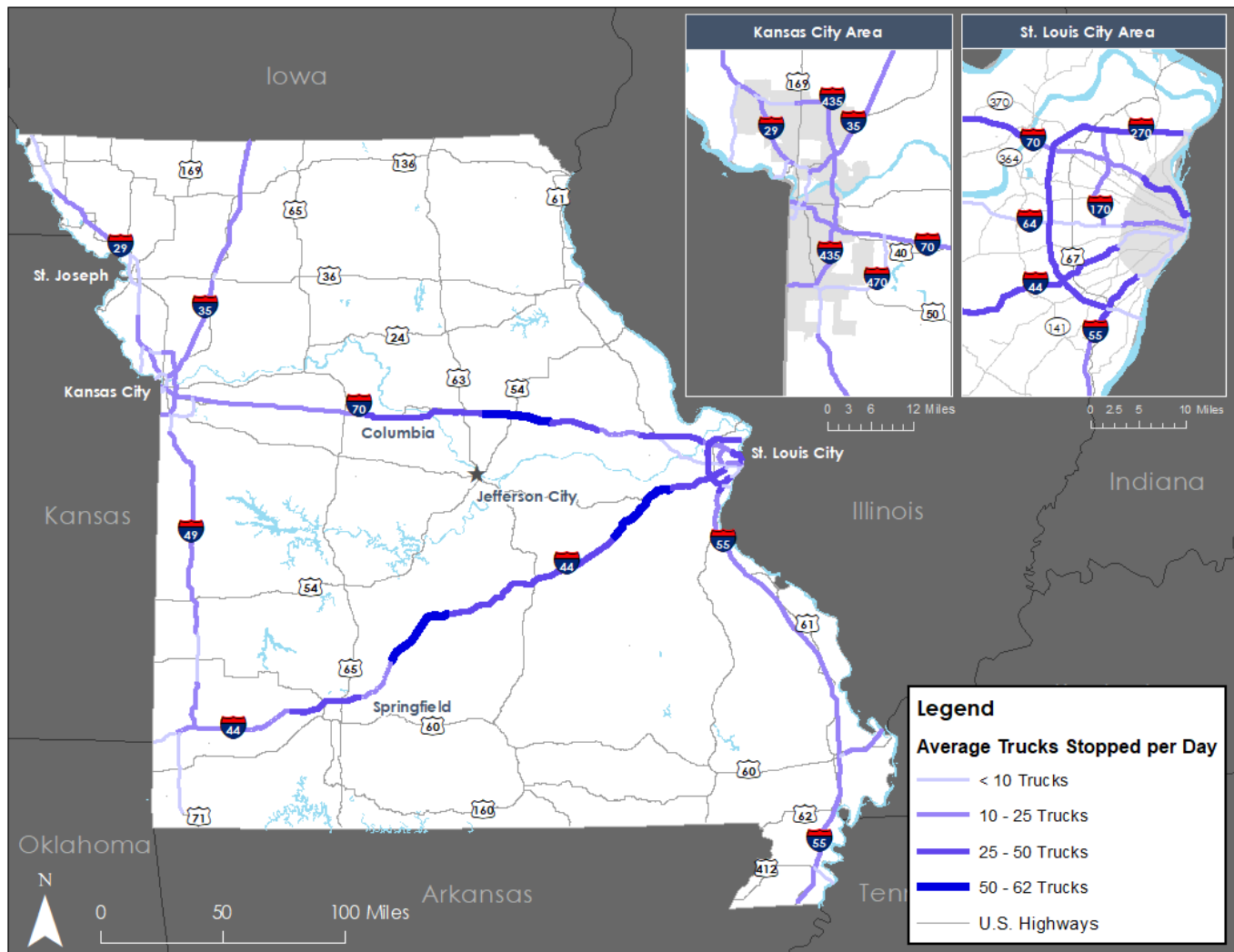
## Trucks Parked on Interstate Right of Way

In addition to the gap analysis above which focuses on trucks parked in or immediately adjacent to designated truck parking areas, trucks also were found parked along interstate ROW statewide. Results from the analysis were aggregated at the county/interstate level, resulting in 73 segments.<sup>13</sup> As shown in Figure 2.8, most stops lasted for less than an hour, although 21% lasted between one and four hours and 8% were for eight to fourteen hours.

Figure 2.20 shows the average daily number of trucks stopped on each county/highway segment. In total, approximately 1,200 trucks stopped somewhere on interstate ROW in Missouri on an average day. Segments with more than 40 trucks per day include I-70 in Callaway County (61 per day), I-44 in Franklin and Laclede counties (55 per day in each), I-70 in St. Louis City, I-44 in Phelps County (44 per day) and I-70 in Cooper County (44 per day).

<sup>13</sup> Note, no trucks were identified as parked on I-270 in St. Louis City.

FIGURE 2.20 “RAW” TRUCKS STOPPED ON INTERSTATE ROW BY HIGHWAY/COUNTY



Source: ATRI. Analysis by Cambridge Systematics (2020).

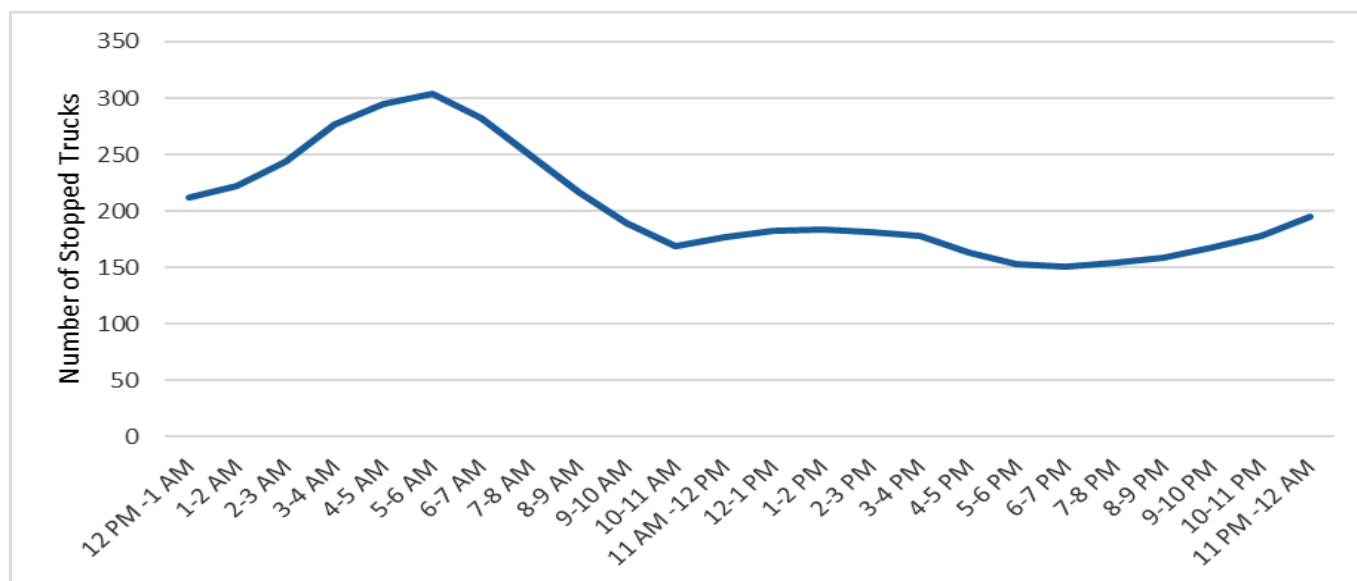
As shown in Figure 2.21, the peak hour for trucks stopped on interstate ROW is between 5 and 6 a.m., slightly later than the peak hour across the 143 designated truck parking sites (2 - 3 a.m.). The exact reason for this difference in peak hour activity is unclear. One possible explanation for this hour is that trucks are parking on interstate ramps near an intended delivery location prior to a morning delivery. Trucks could also be briefly parking roadside during to use a cell phone, pull up map information, or conduct other activity which they cannot do while driving.

Table 2.8 shows the county/highway segments, the number of centerline highway miles, the total number of “raw” stopped trucks based on ATRI GPS data, the average daily number of trucks stopped based on the expanded data and the average daily number of trucks stopped per mile of highway for each segment. The table is sorted by the average number of stopped trucks per day.

I-70 and I-44 dominate in terms of raw stops. These are the two main east-west corridors in Missouri, so the high level of truck traffic is not a surprise. On I-70, utilization at most designated sites is high which is creating a situation

where trucks are deciding to park on highway ROW. In particular, I-70 in St. Louis City has the highest number of stops per interstate centerline miles, though the mileage is shorter than most other segments with a similar number of stopped trucks. The relative lack of inventory in the St. Louis area combined with a large number of businesses and residents requiring service likely are contributing to the high number of trucks parked on ROW in this area.

**FIGURE 2.21 TRUCKS PARKED BY HOUR OF DAY (INTERSTATE ROW)**



Source: ATRI. Analysis by Cambridge Systematics (2020).

**TABLE 2.8 TRUCK PARKING INVENTORY INCLUDED IN GAP ANALYSIS**

County	Interstate	Centerline Miles	“Raw” Stops	Average Daily Stopped Trucks (Expanded)	Average Daily Trucks Stopped per Mile of Highway
CALLAWAY	70	28.2	848	61	2.2
FRANKLIN	44	34.2	767	55	1.6
LACLEDE	44	33.7	764	55	1.6
ST. LOUIS CITY	70	7.1	654	47	6.7
COOPER	70	27.9	607	44	1.6
PHELPS	44	32.2	612	44	1.4
BOONE	70	21.9	537	39	1.8
ST. CHARLES	70	26.8	540	39	1.5
CRAWFORD	44	22.8	518	37	1.6
GREENE	44	31.1	511	37	1.2
ST. LOUIS	44	25.1	447	32	1.3
PULASKI	44	23.5	436	31	1.3
ST. LOUIS	55	8.9	381	27	3.1
MONTGOMERY	70	21.4	360	26	1.2

County	Interstate	Centerline Miles	"Raw" Stops	Average Daily Stopped Trucks (Expanded)	Average Daily Trucks Stopped per Mile of Highway
ST. LOUIS	270	34.5	368	26	0.8
LAFAYETTE	70	33.4	334	24	0.7
HARRISON	35	31.4	314	23	0.7
JASPER	44	21.8	312	22	1.0
VERNON	49	30.1	296	21	0.7
JASPER	49	22.3	282	20	0.9
LAWRENCE	44	27.4	281	20	0.7
SALINE	70	24.2	278	20	0.8
CLAY	35	24.6	249	18	0.7
HOLT	29	32.8	257	18	0.6
JEFFERSON	55	27.8	232	17	0.6
NEW MADRID	55	34	236	17	0.5
CASS	49	29.8	224	16	0.5
CLINTON	35	21	220	16	0.8
JACKSON	70	28.4	228	16	0.6
WARREN	70	17.3	225	16	0.9
DAVISS	35	26	215	15	0.6
PEMISCOT	55	31.9	215	15	0.5
ST. LOUIS CITY	64	6.9	206	15	2.1
STE. GENEVIEVE	55	25.1	214	15	0.6
PLATTE	29	28.1	191	14	0.5
BATES	49	29.4	168	12	0.4
CAPE GIRARDEAU	55	27.3	169	12	0.4
MISSISSIPPI	57	20.2	169	12	0.6
WEBSTER	44	20.8	164	12	0.6
CLAY	435	15.9	159	11	0.7
JACKSON	435	19.5	150	11	0.6
PERRY	55	20.6	157	11	0.5
SCOTT	55	26.1	151	11	0.4
ST. LOUIS	170	10.9	159	11	1.0
MCDONALD	49	13.5	134	10	0.7
ST. LOUIS	70	12.9	145	10	0.8
ST. LOUIS CITY	44	9.8	134	10	1.0
ANDREW	29	15.4	124	9	0.6
NEWTON	49	20.6	126	9	0.4
NEWTON	44	10.7	93	7	0.6

County	Interstate	Centerline Miles	“Raw” Stops	Average Daily Stopped Trucks (Expanded)	Average Daily Trucks Stopped per Mile of Highway
BUCHANAN	29	20.1	85	6	0.3
ST. LOUIS	64	20.5	90	6	0.3
ATCHISON	29	24.8	70	5	0.2
JACKSON	35	4.0	69	5	1.2
JACKSON	49	6.9	64	5	0.7
JACKSON	470	17.1	74	5	0.3
JACKSON	670	2.3	71	5	2.2
PEMISCOT	155	10.7	75	5	0.5
BARTON	49	20.4	51	4	0.2
ST. CHARLES	64	13.2	60	4	0.3
ST. LOUIS CITY	55	7.1	49	4	0.5
BUCHANAN	229	10.2	35	3	0.2
DEKALB	35	3.1	37	3	0.9
JACKSON	29	1.4	37	3	1.8
PLATTE	435	17.3	45	3	0.2
ST. LOUIS	255	4.0	48	3	0.9
CLAY	29	6.2	25	2	0.3
PLATTE	635	3.7	16	1	0.3
ANDREW	229	4.7	3	0	0.0
CALDWELL	35	< 0.1	3	0	9.7
MARION	72	2.2	2	0	0.1
SCOTT	57	2.2	2	0	0.1
ST. LOUIS CITY	270	0.7	0	0	0.0

Source: ATRI. Analysis by Cambridge Systematics (2020). Errors due to rounding.

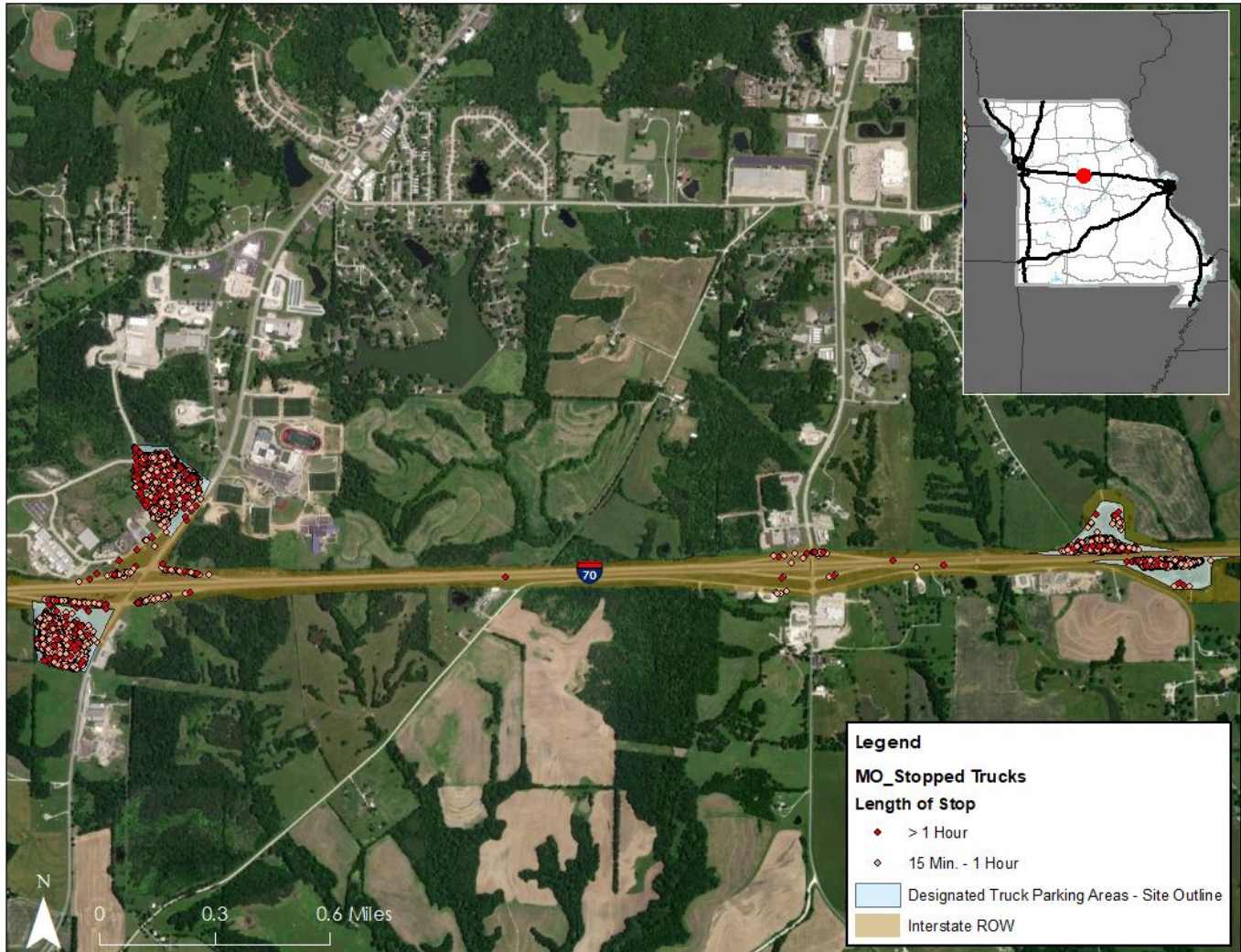
Figure 2.22 shows an example of a cluster of trucks parked on interstate 70 in Cooper County near the Boonville Rest Area (EB and WB) at mile marker 104, as well as a Love’s and Pilot Travel Center at Exit 101. All four sites shown in this image are over capacity at the peak hour (2 - 3 a.m.) as well as for multiple additional hours throughout the day and many stopped trucks are visible on the highway entry and exit ramps near these sites.

Figure 2.23 combines site utilization and interstate ROW parking data. Not surprisingly, there are several locations with over capacity sites and a high number of trucks parked on interstate ROW. For example, I-44 between Springfield and St. Louis has several designated sites over capacity and adjacent interstate segments with higher levels of trucks parking on the ROW. I-70 also has several similar areas. However, the pattern is not statewide. The



Mineola Truck Parking Facility on I-70 in Montgomery County is one location with both sites (EB and WB) under capacity at the peak hour but with a high level of trucks on the ROW.<sup>14</sup>

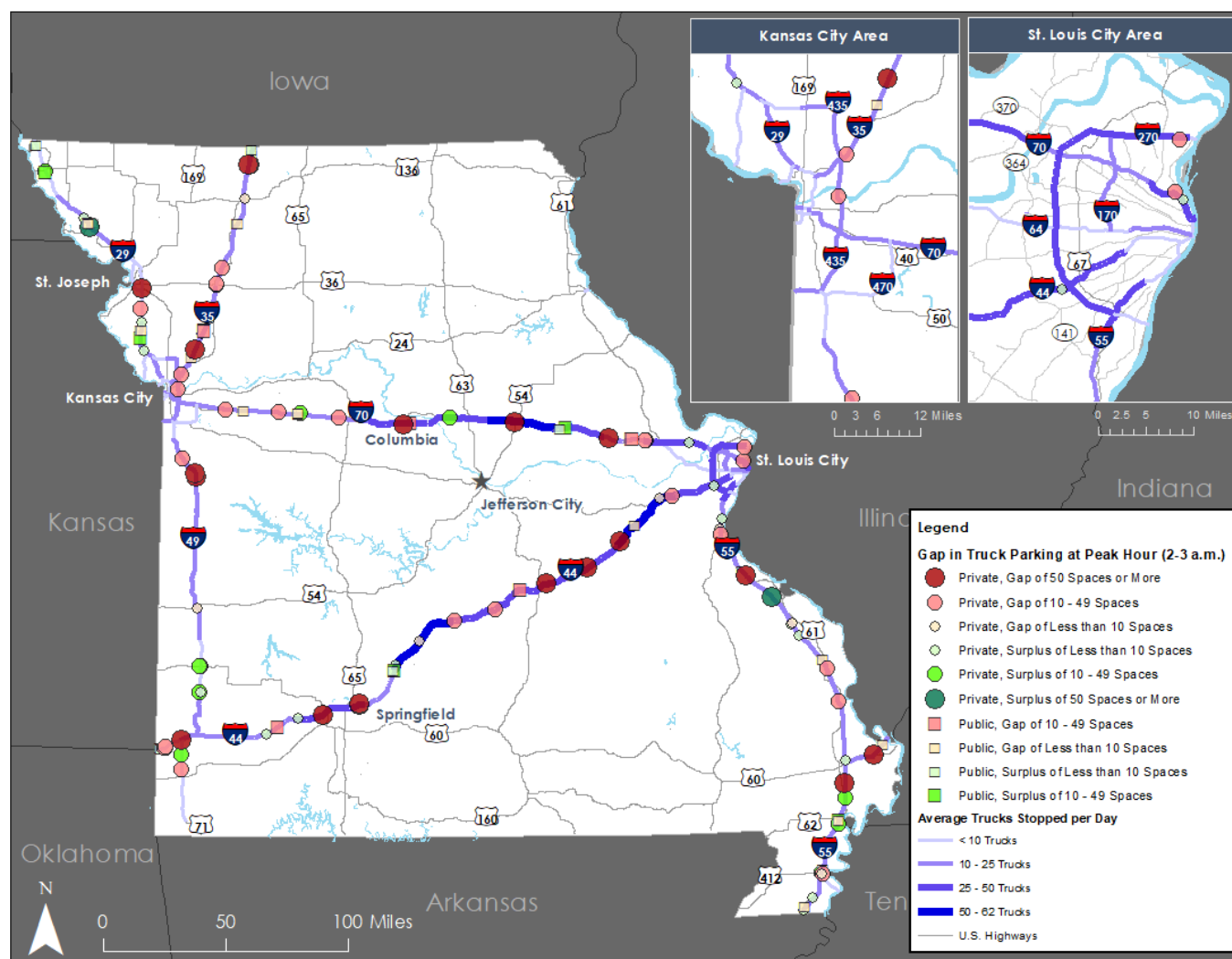
**FIGURE 2.22 “RAW” TRUCKS STOPPED ON INTERSTATE ROW EXAMPLE – I-70 IN COOPER COUNTY**



Source: ATRI. Analysis by Cambridge Systematics (2020).

<sup>14</sup> The eastbound side is nearly at capacity and is over capacity between 4 and 6 a.m.

FIGURE 2.23 SITE GAP AND TRUCKS PARKED IN INTERSTATE ROW



Source: ATRI. Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

Table 2.9 provides the combined gap at both designated sites and adds the trucks parked within the ROW by MoDOT District. During the peak hour (2 - 3 a.m.), there is a shortage of approximately 1,800 spaces created by trucks overflowing designated sites and trucks parked on interstate ROW. The problem is most acute in the Central District along I-70 and I-44 with a gap of approximately 550 spaces at the peak hour.

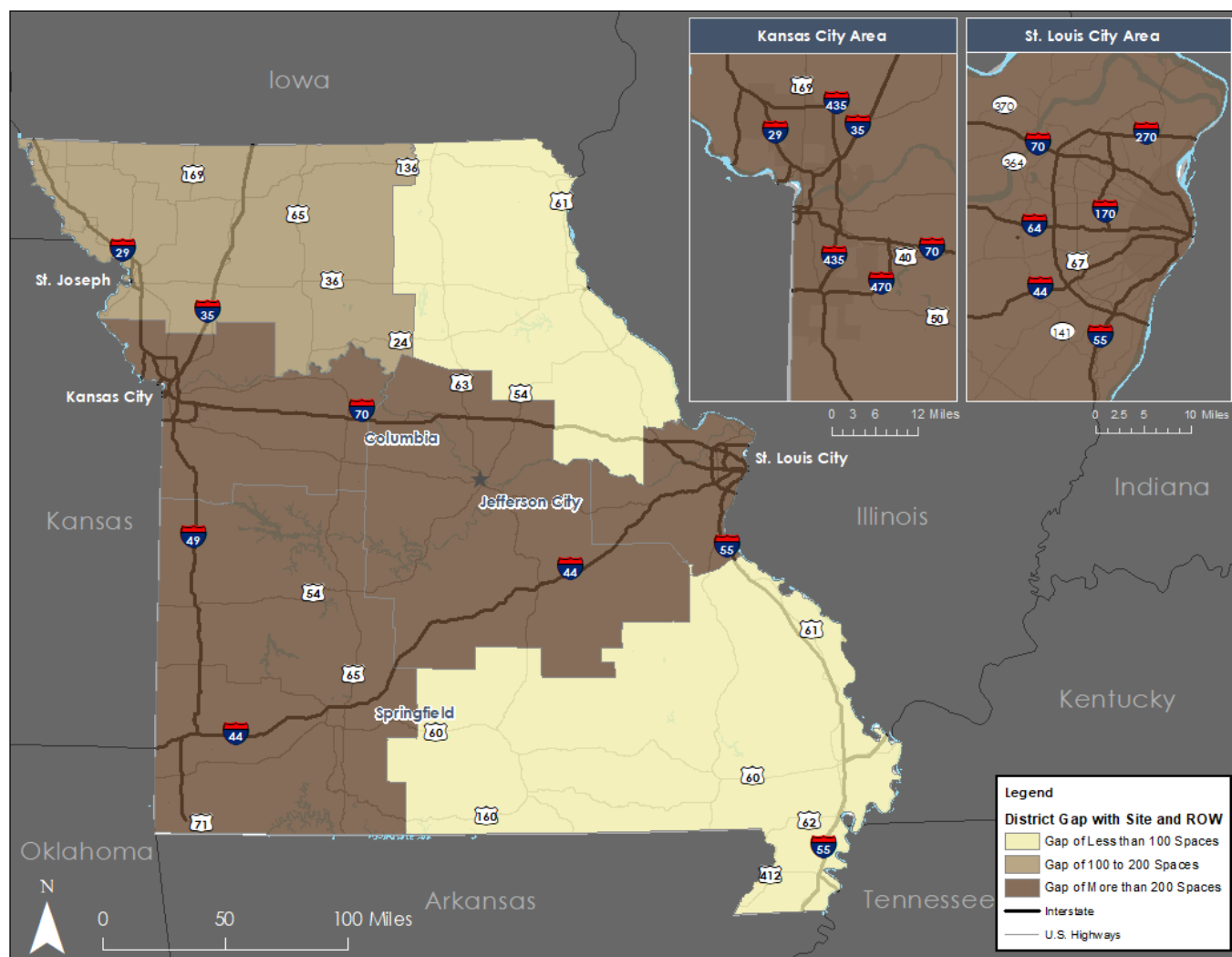
Figure 2.24 shows the gap by District and parking location as well as additional trucks parked on the highway ROW as a single map. It is important to remember that this data only includes designated locations within one-half mile of the interstate system and trucks parked on ROW along that system. Staging parking, which often occurs on local streets near origins and destinations in urban areas or near freight-generating businesses, is not well-captured in this analysis. The demand for truck parking in those areas is likely even higher than what this analysis shows.

TABLE 2.9 TRUCK PARKING INVENTORY AND GAP BY DISTRICT

District	Total Inventory	Number of Sites at or Over Capacity at Peak Hour (2 - 3 a.m.)	Total Demand at Designated Sites at Peak Hour	Gap at Peak Hour	Additional Trucks Parked on Interstate ROW at Peak Hour	Total Gap at Peak Hour
Central	1,246	14	1,734	488	67	555
Kansas City	1,530	14	1,869	339	28	367
Northeast	322	4	386	64	8	72
Northwest	869	14	985	116	18	134
Southeast	1,633	17	1,678	45	21	66
Southwest	2,056	12	2,353	297	44	341
St. Louis	713	12	921	208	59	267
<b>Total</b>	<b>8,369</b>	<b>87</b>	<b>9,926</b>	<b>1,557</b>	<b>245</b>	<b>1,802</b>

Source: MoDOT. Truck parking websites. Analysis by Cambridge Systematics (2020). Note: Errors due to rounding.

FIGURE 2.24 GAP AT PEAK HOUR BY MODOT DISTRICT (SITES AND INTERSTATE ROW)

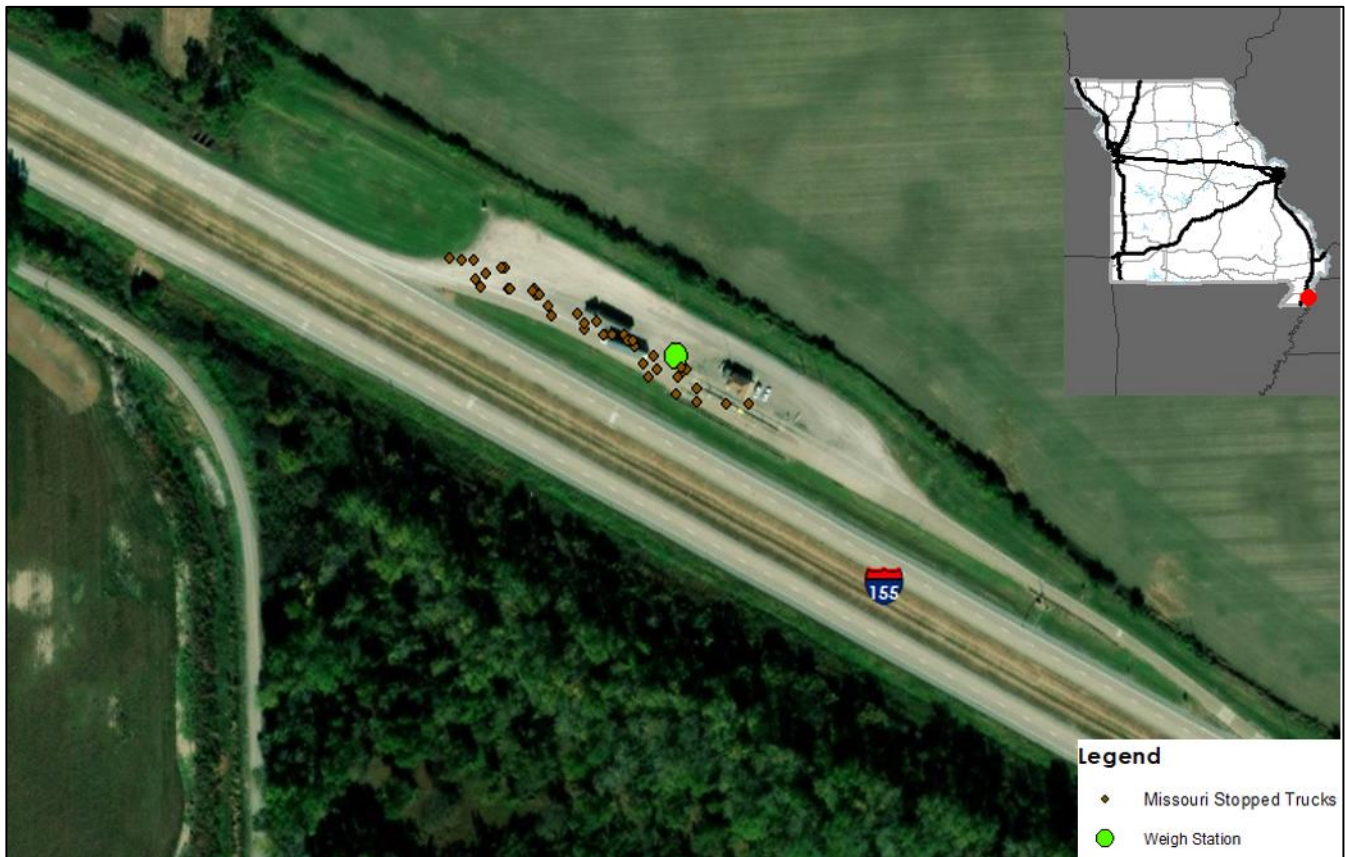


Source: ATRI. Truck parking websites and applications. Analysis by Cambridge Systematics (2020).

Finally, approximately 900 trucks were identified as stopped at one of Missouri's 20 weigh stations. These stops were not included in either the designated site or interstate ROW analysis as it is nearly impossible to differentiate between stops associated with enforcement activity (a truck is stopped at the site for an inspection or has been put out of service) and stops to fulfil HOS requirements. However, it is important to note that weigh stations are commonly used in the U.S. as undesignated parking areas when not being actively used for enforcement. An example of trucks stopped at the Caruthersville weigh station on I-155 is shown in Figure 2.25



FIGURE 2.25 TRUCKS PARKED AT CARUTHERSVILLE WEIGH STATION (I-155)



Source: ATRI. Analysis by Cambridge Systematics (2020).

## 2.4 Truck Parking and Other Factors

### Safety

Trucks parked in undesignated areas along the side of the road, on interchange ramps or even in non-truck areas of a rest area can cause safety concerns for both the drivers and the traveling public. A review of MoDOT's crash data for 2015-2019 revealed 72,144 crashes involving a truck with 83,522 total trucks involved (indicating a number

of crashes involved multiple trucks). These crashes also included an additional 34,641 passenger vehicles involved in crashes with trucks bringing the total vehicles involved in truck crashes to 118,163.

Those crashes killed 1,171 people and injured an additional 24,353 people. Of the fatalities, 762 were drivers of trucks while 409 were either drivers or passengers of passenger vehicles. More detail of these fatalities and injuries is found in the Safety section of this document.

In 848 crashes, one of three contributing circumstances was ascribed to the truck driver or passenger vehicle driver. Of those 848 crashes, 614 were trucks while 234 were passenger vehicles.

- The truck and/or passenger vehicle was improperly parked, meaning that the vehicle was improperly parked in a place normally designated for parking, or improperly parked along the roadway traffic lanes, such as blocking a driveway, beside a fire hydrant, or in a loading zone;
- The truck and/or passenger vehicle was improperly stopped on roadway, meaning a vehicle in-transport that is stopped on a roadway inappropriately or when not directed to stop by a traffic control device or law enforcement officer;
- The truck and/or passenger vehicle improperly started from park, meaning that a vehicle was parked and the improper start from the parked position contributed to the crash.

These three factors are the most likely to indicate that a truck and/or passenger vehicle was parked in an unauthorized location which contributed to a crash. These 848 crashes, involving 1,124 vehicles, resulted in 17 fatalities, 54 serious injuries and 179 minor injuries amongst all vehicles involved.

Contributing factors cited for the vehicles involved in these incidents involving 1,124 vehicles is shown in Table 2.10. Note that the other vehicle could be either another truck or a non-commercial vehicle (NCV).

**TABLE 2.10 CONTRIBUTING CIRCUMSTANCES FOR OTHER VEHICLES INVOLVED IN CRASHES WITH TRUCK PARKING-RELATED CONTRIBUTING FACTORS**

Top Contributing Circumstance	Number of Vehicles with that Circumstance	Number of Fatalities	Number of Disabling Injuries	Number of Minor Injuries
Improperly Stopped on Roadway	752	17	36	142
Improperly Parked	251	0	11	28
Improper Start from Park	121	0	8	9

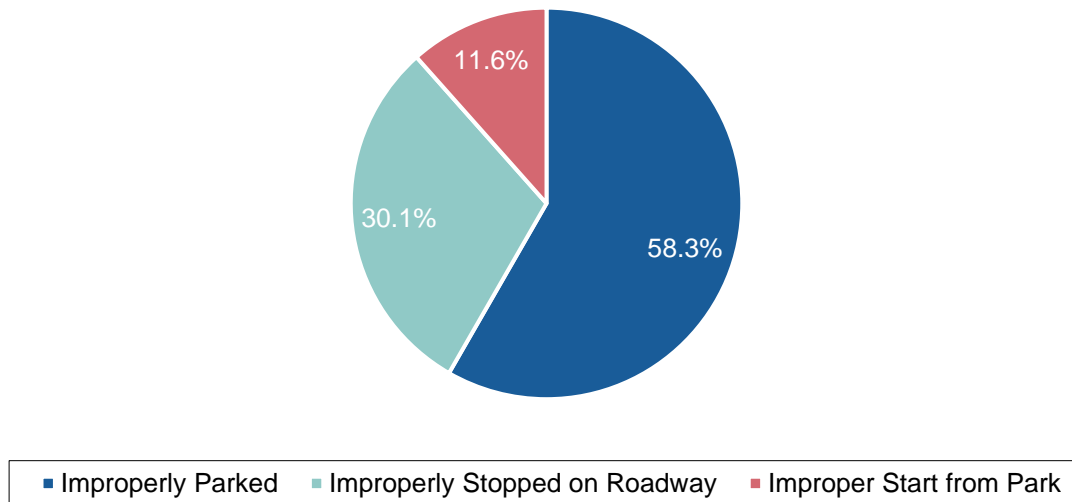
Source: MoDOT

The highest number of all injuries and fatalities occurred when a truck or passenger vehicle was improperly stopped on a roadway (67%) followed by improperly parked (22%), and improper start from park (11%). No fatalities occurred when vehicles were improperly parked or improper start from park.

The percent of crashes involving these three factors is shown in Figure 2.26. The severity and location of these incidents are shown in Figure 2.27.

Not surprisingly, the urban areas near St. Louis and Kansas City exhibit the greatest concentrations of these types of crashes as they are areas where trucks are likely to park on the side of the road near an origin or destination while waiting for a delivery window. Fatal crashes are spread statewide with no discernible clusters.

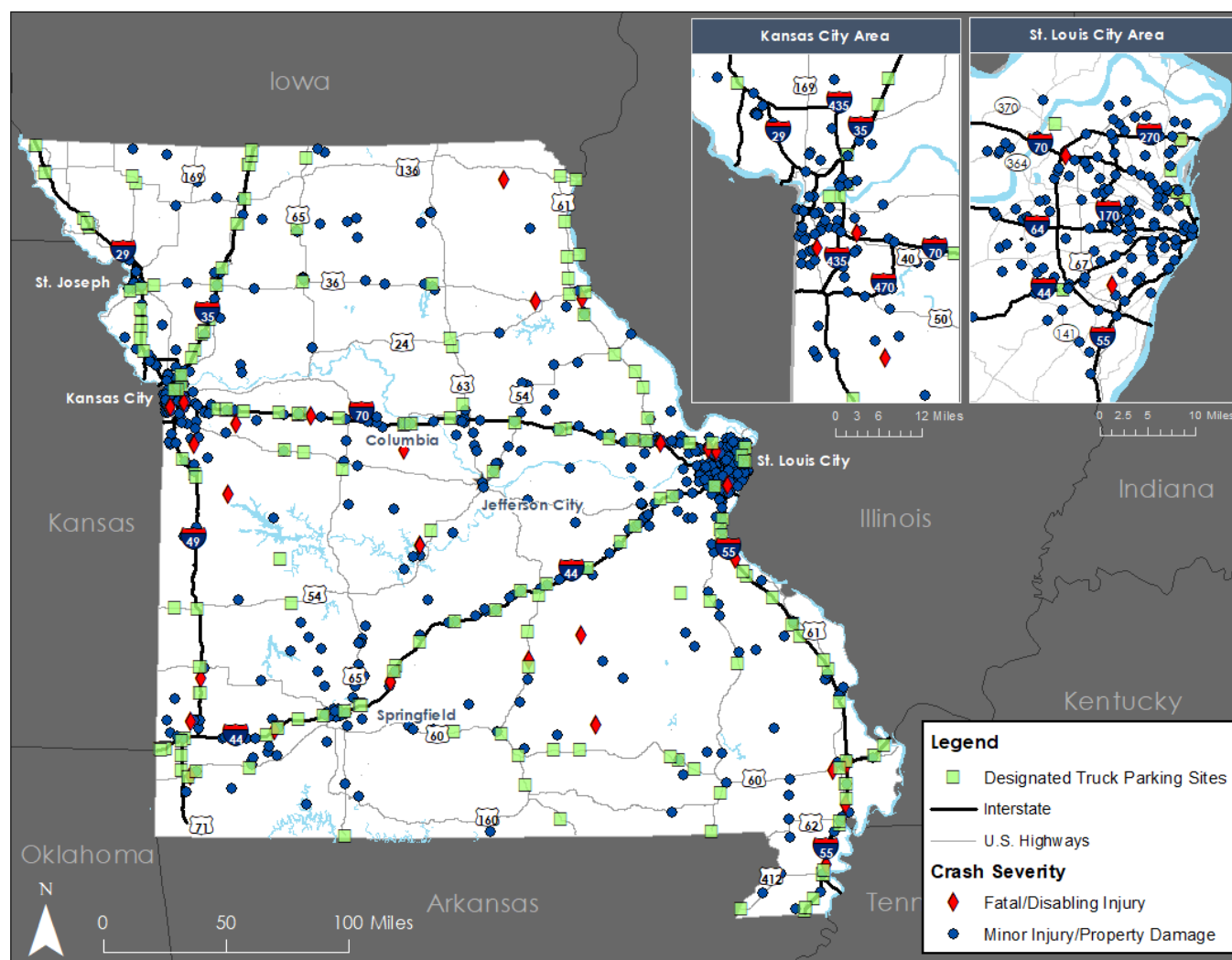
**FIGURE 2.26 MISSOURI TRUCK-INVOLVED CRASH CONTRIBUTING CIRCUMSTANCES**



Source: MoDOT, Analysis by Cambridge Systematics (2020).



FIGURE 2.27 MISSOURI TRUCK PARKING AND RELATED TRUCK CRASHES BY SEVERITY (2015-2019)

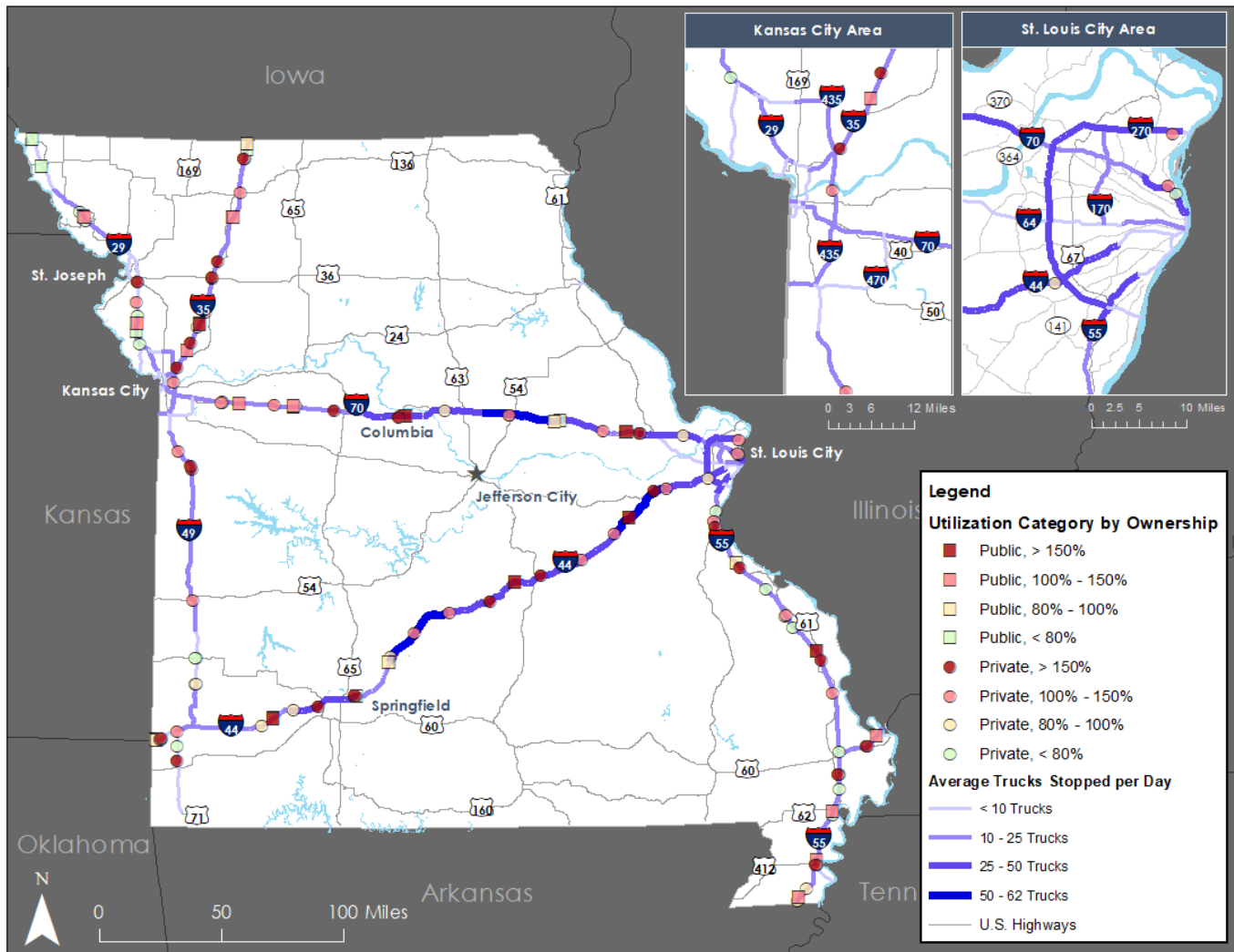


Source: MoDOT. Analysis by HG Consulting (2020).

Additional analysis was conducted to determine the number of crashes occurring near designated truck parking sites. Figure 2.28 shows the 51 crashes involving a truck that occurred within one mile of these locations<sup>15</sup> as well as the utilization percent at each site and the number of trucks parked on interstate ROW. Nearly all these crashes are clustered near sites identified as at- or over capacity. For publicly owned sites, these areas include the Boonville and Wright City Rest Areas on I-70, the Doolittle Truck Parking Facility on I-44, the Lathrop Rest Area on I-35 and the Marston Truck Parking Facility and Welcome Center on I-55.

<sup>15</sup> The crash occurred on any road within 1 mile of the facility.

**FIGURE 2.28 CRASHES RELATED TO TRUCKS IMPROPERLY PARKED, IMPROPERLY STOPPED ON ROADWAY AND IMPROPER START FROM PARK WITHIN ONE MILE OF A DESIGNATED TRUCK PARKING SITE**

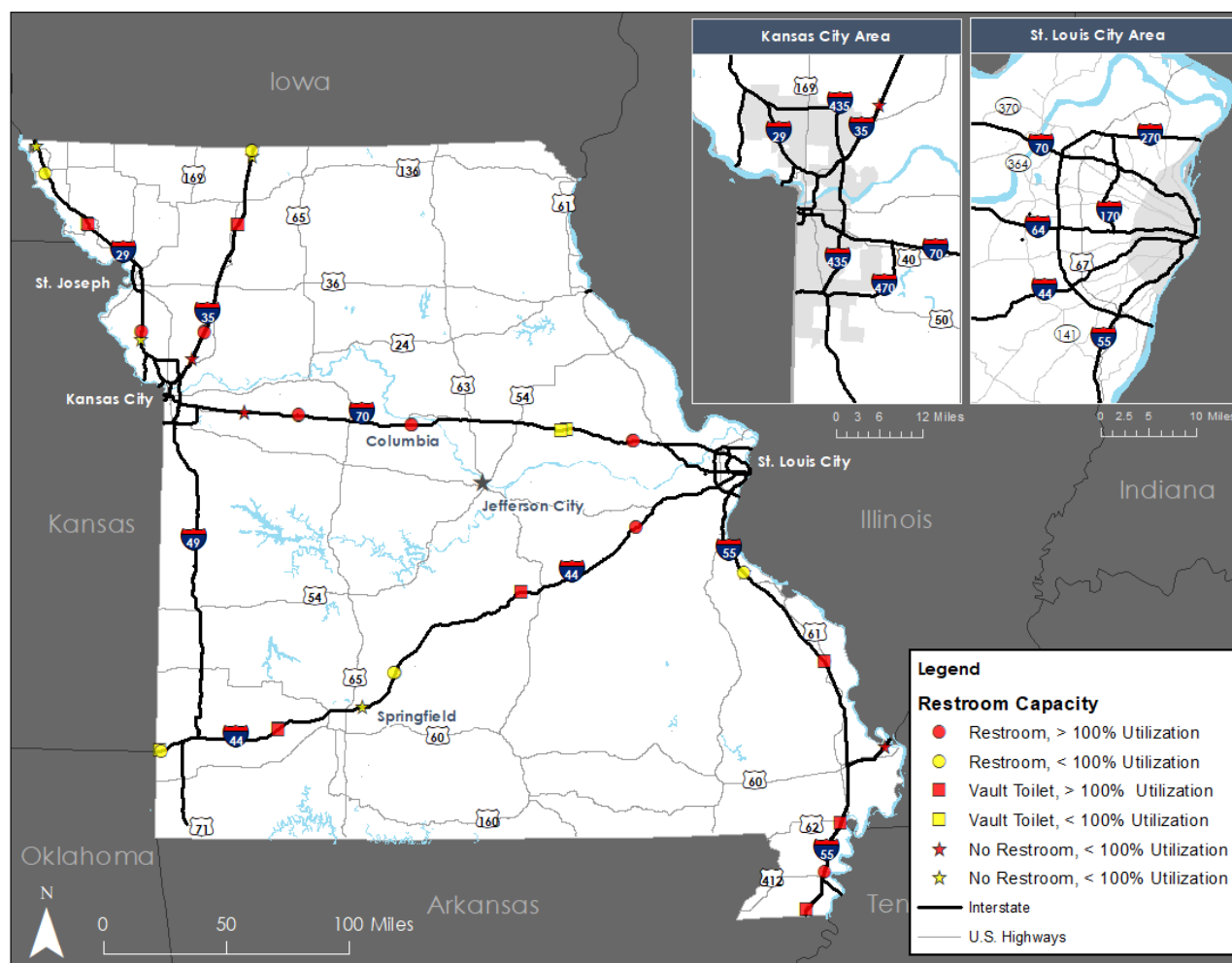


Source: MoDOT. Analysis by Cambridge Systematics, HG Consulting (2020).

## Restrooms

One of the most critical amenities cited by drivers nationwide is access to a restroom. Of the 45 publicly owned locations within one-half mile of the interstates, 21 have a restroom with running water, 15 have a vault toilet with no running water and nine sites have neither. The average utilization at the peak hour (2 - 3 a.m.) at the nine sites without facilities is 85% (average of 15 spaces per site) compared to 126% at sites with vault toilets (average of 24 spaces per site) and 126% (average of 31 spaces per site) at sites with a restroom. This indicates a substantially higher overall usage at locations with a restroom or vault toilet and suggests that this amenity is a critical factor making these sites attractive to drivers. Figure 2.29 shows this difference. Additional information about amenities at publicly owned locations is found in the site profiles in Appendix A.

FIGURE 2.29 SITE UTILIZATION AND PRESENCE OF RESTROOMS AT PUBLICLY OWNED SITES

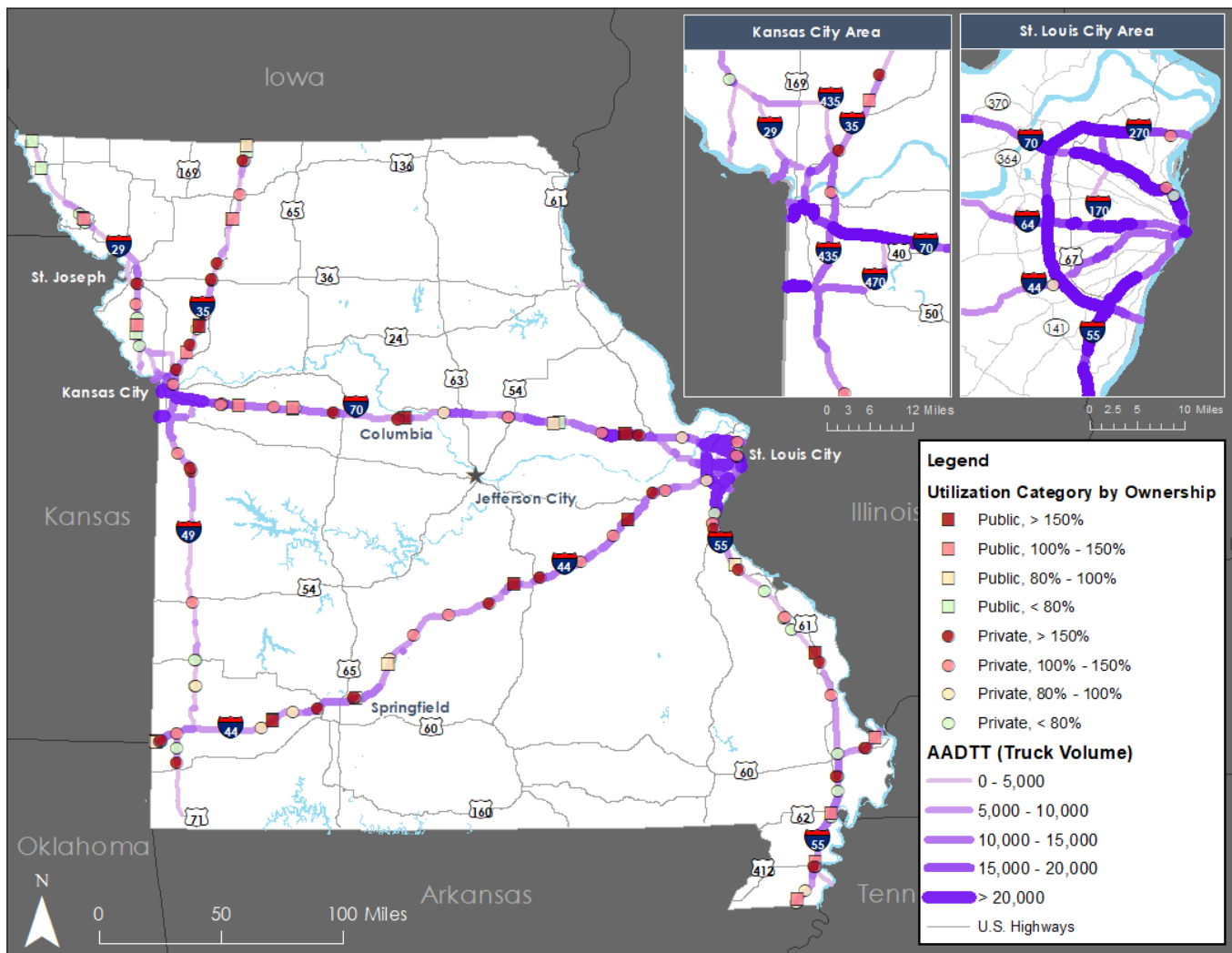


Source: MoDOT. Analysis by Cambridge Systematics (2020).

## Truck Volumes

Figure 2.30 shows site utilization compared with truck volumes. The urban areas of St. Louis and Kansas City have the highest truck volumes in the state but comparably low inventories. However, much of this truck traffic is likely regional or local in nature and so has less of an impact on truck parking demand during the peak hour than inter-regional or long-haul trips. I-70 near the Wright City Rest Area, I-55 near the Arkansas border and I-44 entering Missouri from Oklahoma are also segments with high volumes near at or over capacity sites.

FIGURE 2.30 SITE UTILIZATION AND TRUCK VOLUMES

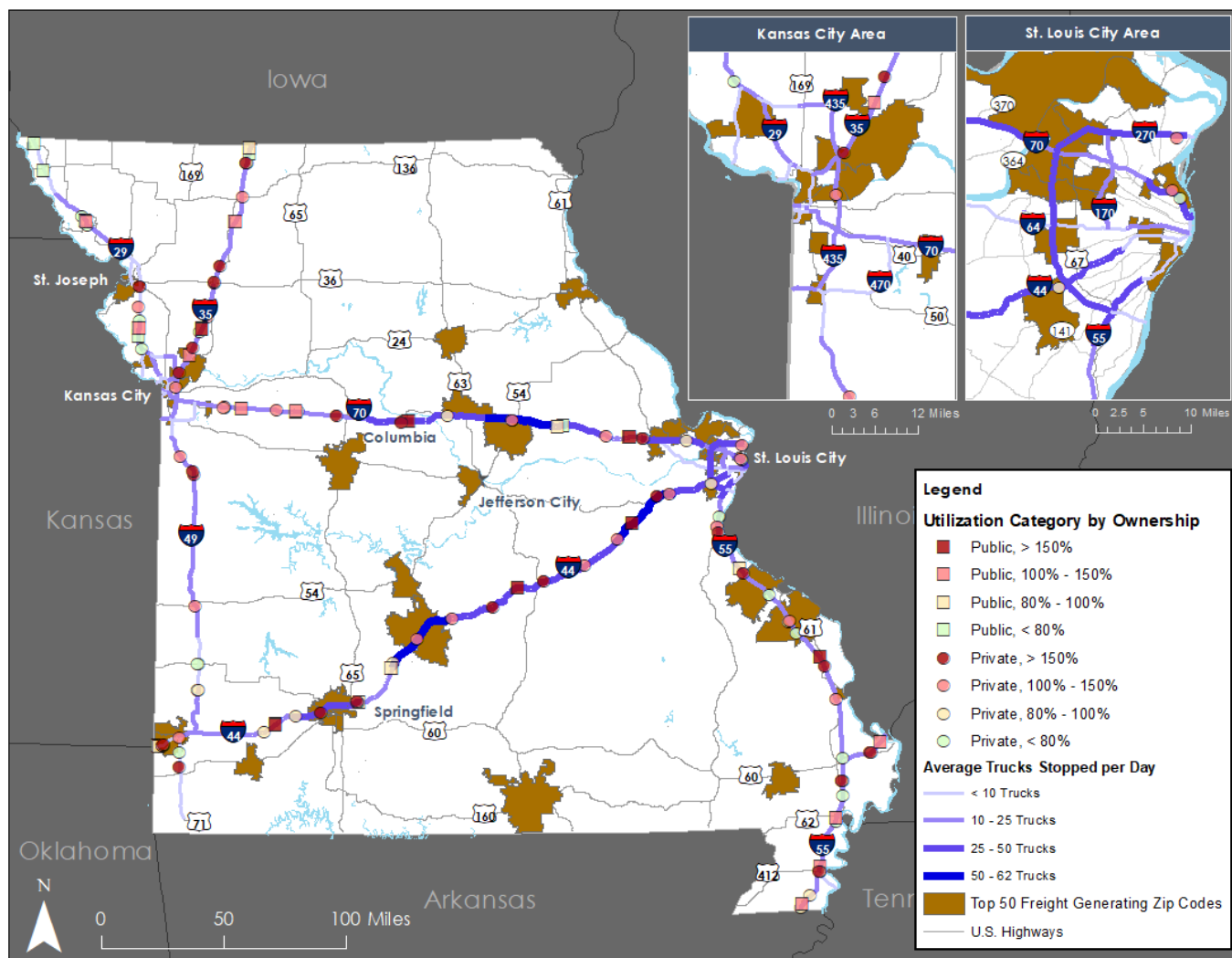


Source: MoDOT. Analysis by Cambridge Systematics (2020).

## Top Freight Generators

Figure 2.31 compares the top 50 freight generating zip codes (based on all modes) in Missouri with truck parking. Some of the interstate segments with the highest number of trucks parked on ROW overlap with these areas including I-70 in Callaway County (ZIP code 65251) and I-44 in Laclede County (ZIP code 65536). However, the lack of truck parking data beyond the interstate system makes it difficult to determine if this pattern holds true statewide.

FIGURE 2.31 SITE UTILIZATION, ROW PARKING AND TOP 50 FREIGHT GENERATING ZIP CODES



Source: MoDOT. Analysis by Cambridge Systematics (2020).

## 3.0 Truck Parking Outreach

To supplement the data analyzed as part of Section 2.0, MoDOT engaged with truck drivers via a web-based survey and a “roundtable” discussion (conducted via phone) to hear more about truck parking needs and issues, as well as validate initial findings and recommendations. A summary of these engagement efforts is included in this Section.

### 3.1 Truck Driver Survey

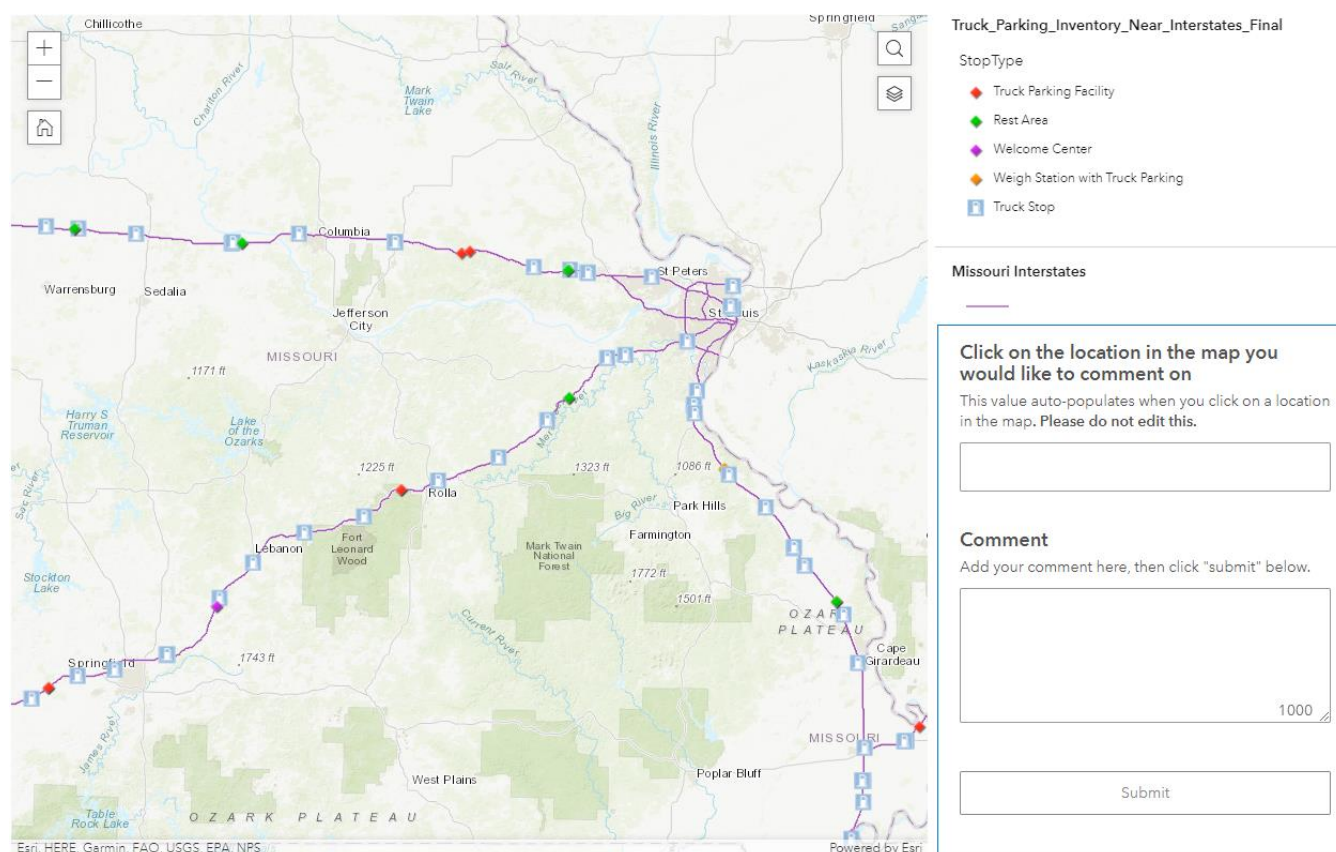
To reach as many active truck drivers as possible, the CS team distributed a survey via email on February 16, 2021 that posed a series of questions and used an interactive map component where users could provide their input. The email was sent to over 7,600 email addresses of truck drivers based in Missouri, compiled by the CS team using a national driver database. The email was opened by 1,160 recipients (19%), of which 63 clicked on the survey link. The survey was live through April 2021, and in addition to the email blast it was shared and promoted via MoDOT’S website and Industry Forum events held in February 2021. Ultimately, 16 drivers completed the survey questions in full. This small data sample provided some anecdotal information that was useful in developing the questions posed during the Truck Driver Roundtable, as discussed in Section 3.2. The complete list of survey questions are included in Appendix C.

The survey consisted of two components: 1) a series of 19 survey questions, and 2) an interactive mapping tool where participants can add notes about existing designated parking locations near interstates in Missouri (such as where more spaces are needed, desired amenities, etc.). Figure 3.1 presents a screenshot of the mapping tool.

The survey began with a few demographic questions inquiring about gender identity and employment type, as well as a fill-in box for name and e-mail address. None of these questions were mandatory. Five participants identified themselves as female, while the remaining 11 identified as male. 44% of respondents described their employment type as “Fleet Executive Manager Dispatch”, while 6% selected “Owner Operator/Independent Driver” and 50% selected “other”. The remaining questions were specific to the driver’s experience with truck parking in Missouri.



FIGURE 3.1 TRUCK DRIVER SURVEY INTERACTIVE MAPPING TOOL

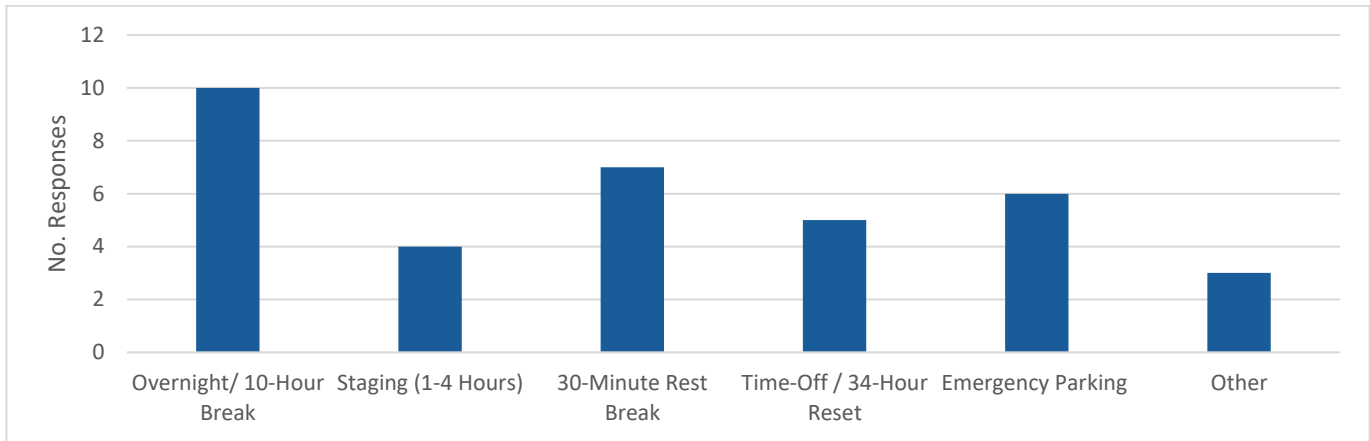


Source: Cambridge Systematics using ArcGIS Online.

The majority of respondents indicated that their typical length of haul is over 1,000 miles, followed by 500 to 999 miles and shorter trips of 100 to 499 miles. Others replied that their drives vary, or they do not have a typical length. Of the four long-haul trips of over 1,000 miles, two respondents described their primary vehicle configuration as 5-axle refrigerated trailers, one as a 5-axle flat bed and one as an oversized truck. In addition, the majority of respondents indicated that they are on the road quite frequently. When asked, *How often do you operate in Missouri?*, 50% of respondents noted that they operate in Missouri on a daily basis, while 38% do so weekly and the remaining 12% do so rarely.

For the question, *What type of truck parking do you regularly need in Missouri?*, participants had the opportunity to select more than one option. For example, participants could specify their need for overnight/10-hour break in addition to the 30-minute rest break. Responses to this question are shown in Figure 3.2. Based on their needs, drivers were able to rank the difficulty of finding this type of parking using a scale ranging from very difficult to not difficult, as shown in Figure 3.3.

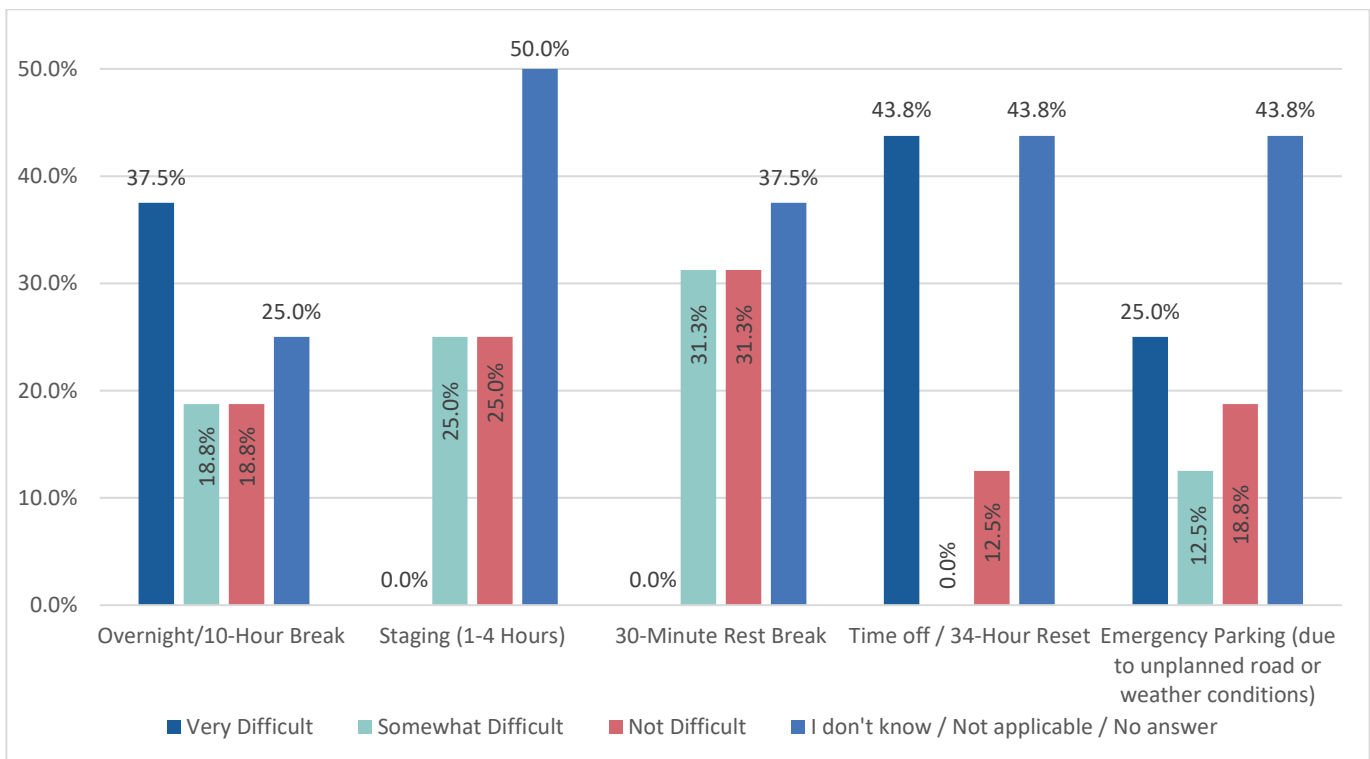
**FIGURE 3.2 SURVEY RESULTS: WHAT TYPE OF TRUCK PARKING DO YOU REGULARLY NEED IN MISSOURI?**



Source: Missouri Truck Driver Survey Results

Looking closely at the results of the ranking of difficulty by truck parking type, “Time-off/34-hour Reset” was the most difficult to find, followed by “Overnight/10-hour break”. “Staging (1-4 hours)” and “30-minute rest break” was described as *somewhat difficult to not difficult*.

**FIGURE 3.3 SURVEY RESULTS: DIFFICULTY IN FINDING TRUCK PARKING BY TYPE**



Source: Missouri Truck Driver Survey Results

In response to the question about how long drivers typically spend looking for truck parking in Missouri, most drivers (31%) indicated it takes them less than 15 minutes, while 19% indicated it usually takes more than an hour, 12% indicated 45-60 minutes and 25% indicated 15-30 minutes. When asked to compare how easy it is to find safe truck parking in Missouri against other states, 63% of respondents stated it is *about the same*, 13% indicated it is *a little or much harder to find parking in Missouri*, and similarly 12% percent said it is *a little or much easier to find parking in Missouri*. Despite the consensus that truck parking is relatively easy to find in Missouri, three drivers noted that they park in an undesignated area (such as the side of a road or a vacant property) multiple times a week, and two indicated to do this multiple times a day. In order to find truck parking – in Missouri or any other state – drivers noted that they typically either drive around an area (8 responses) in search of available spaces or use a truck parking mobile app (9 responses). A select few noted using real time information signs or static roadside signs.

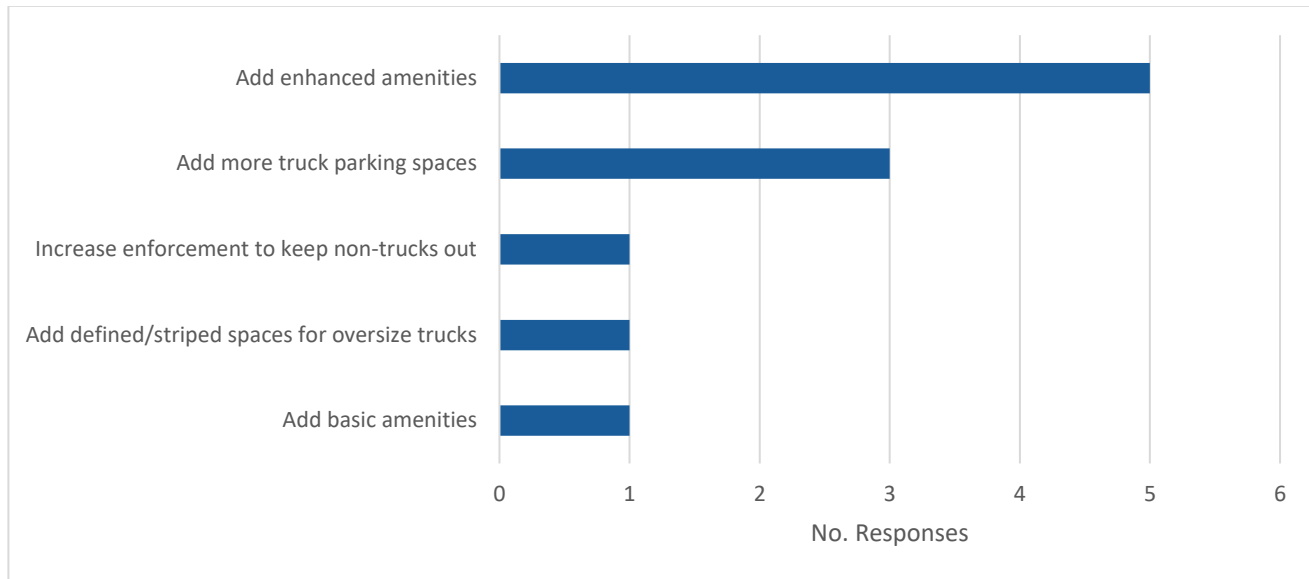
In order to understand driver preferences for specific truck parking amenities, respondents were asked to rank 11 amenities in order of importance. The results of this question are shown in Table 3.1. Flushing toilets were the top ranked amenity by far, followed by lighting, enhanced vending machines and wi-fi.

**TABLE 3.1 TRUCK PARKING AMENITY PREFERENCES**

Amenity	Overall Ranking	Total Score	Mean Score
Flushing toilets	1	39	3.0
Lighting	2	52	4.0
Enhanced vending machines	3	60	4.6
Wi-Fi	4	77	5.9
Defined/striped oversize vehicle parking spaces	5	85	6.5
Paved/striped spaces	6	87	6.7
Real time parking space availability information	7	91	7.0
Fencing	8	95	7.3
Green space and walking paths	9	96	7.4
Driver lounge	10	98	7.5
Vault toilets	11	114	8.8

Source: Missouri Truck Driver Survey Results

Missouri has a number of truck-parking only facilities with limited amenities, such as lighting, trash cans and potentially a vault toilet (sometimes no restroom is provided). One survey question asked respondents to give their opinion about these facilities, and 53% responded that *they are great or they are OK, I use them sometimes*. 33% indicated that *they are not good* and 13% indicated that they had no opinion of these facilities. For those that thought these facilities were “ok”, “not good”, or “really bad”, the survey asked a follow-up question to understand what could be done to make the sites better, as shown in Figure 3.4. Most respondents indicated a desire to add enhanced amenities, such as truck parking availability signs, enhanced vending machines, flushable toilets, restrooms, or wi-fi. Just one participant indicated that adding basic amenities, such as vault toilets, lighting, fencing, or paved/striped spaces would be sufficient.

**FIGURE 3.4 SURVEY RESULTS: IMPROVEMENTS TO LIMITED AMENITY FACILITIES**

Source: Missouri Truck Driver Survey Results

The survey also asked drivers about their experiences when it comes to finding truck parking and once they are parked. Several scenarios were provided as examples and respondents were asked to specify how often these situations occurred. As shown in Table 3.2, the *lack of real-time information about how many spaces are available at parking sites* had the highest rate of occurrence, shown highlighted in **bold**.

**TABLE 3.2 TRUCK PARKING SCENARIOS**

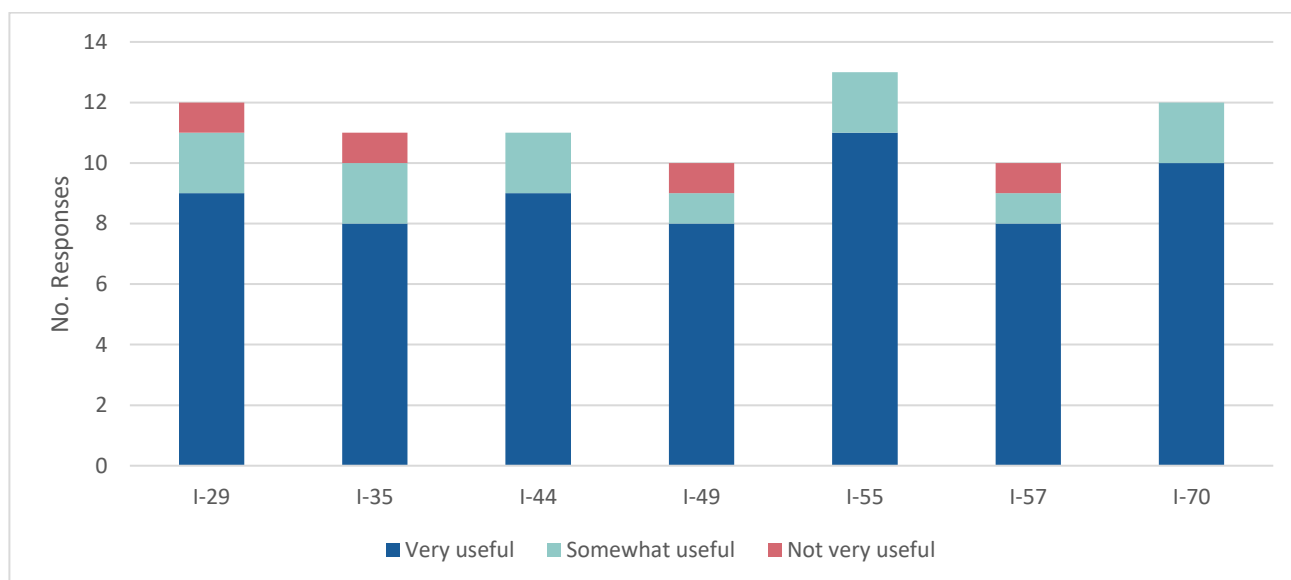
Scenario	Rate of Occurrence				
	Never	Rarely	Sometimes	Often	Always
Because I cannot park on-site while waiting to make a delivery, I park on local roads, in parking lots of retail stores, or in empty/abandoned parking lots nearby while waiting for my delivery appointment or to be called to the dock.	10.0%	20.0%	30.0%	30.0%	10.0%
I am asked to move by enforcement if parked in an undesignated location.	20.0%	10.0%	50.0%	10.0%	10.0%
My truck is damaged while parked	30.0%	30.0%	40.0%	0.0%	0.0%
I cannot find parking for an oversize vehicle configuration	37.5%	25.0%	25.0%	12.5%	0.0%
There is a lack of amenities at public parking sites	11.1%	22.2%	22.2%	22.2%	22.2%
I do not know where to find information on where truck parking sites are located.	11.1%	22.2%	22.2%	22.2%	22.2%
There is a lack of real-time information about how many spaces are available at parking sites	10.0%	10.0%	10.0%	<b>30.0%</b>	<b>40.0%</b>

Source: Missouri Truck Driver Survey Results

As a follow up to the previous question, the survey asked drivers how useful a system that tells drivers whether spots are available at nearby public parking sites in Missouri would be on specific interstate corridors, as shown in

Figure 3.5. Drivers indicated that a truck parking availability system would be useful on all interstate corridors, especially I-55 and I-70.

**FIGURE 3.5 USEFULNESS OF TRUCK PARKING AVAILABILITY SYSTEM ON INTERSTATE CORRIDORS**



Source: Missouri Truck Driver Survey Results

The open-ended map questions did not collect much feedback other than one recommendation, which was to focus on providing truck parking on other highways besides interstates, such as MO 13, U.S. 60, U.S. 65, U.S. 63 and U.S. 61.

## 3.2 Truck Driver Roundtable

In addition to the truck driver survey, the CS team partnered with the Trucking Solutions Group to hold a “roundtable” discussion via phone to seek input from truck drivers who are active in Missouri, but not necessarily based in Missouri. The TSG is a collection of individual drivers who connect via phone regularly to share resources and discuss issues pertaining to their profession. The TSG agreed to allow the CS team and MoDOT to host one meeting to specifically discuss truck parking issues in Missouri. This conversation occurred on May 18, 2021 via phone conference. Topics covered included what Missouri is doing well, what it can improve, where additional truck parking facilities are needed, which services and facilities are most critical given limited resources, and how to communicate with drivers about truck parking availability and needs. This section will summarize the key takeaways from this discussion. The full list of questions asked during the roundtable are included in Appendix D.

### What Missouri Does Well

Drivers noted that Missouri is doing a lot right when it comes to truck parking. First, they believe that there are a number of well-maintained and charming rest stops and truck parking facilities along I-44 and I-70. Additionally, there are nice facilities along I-35 in Eagleville, which are former weigh stations converted into truck parking sites. Drivers noted that these facilities have “personality” and provide an opportunity for drivers to stop and interact with

the different cultures in Missouri, such as Mennonite and Amish communities. Drivers also noted that they enjoy the memorabilia in these facilities, such as the Route-66 display at a rest stop along I-44.

In addition to the physical facilities, drivers noted that MoDOT, particularly the Motor Carrier Services Division, provides excellent customer service to drivers. When interacting over the phone or in physical offices, drivers remarked that MoDOT's customer service experience is superior compared to other states where they operate. They appreciate the lengths that staff members go to help and accommodate their needs. Additionally, they appreciate the department's communications on road closures and detours that they receive by email.

## Areas that Need More Truck Parking

During the roundtable discussion, the CS team asked drivers about specific locations in Missouri where more truck parking is needed. Drivers first noted that more truck parking could be made available along I-55, as this interstate has less parking available in comparison with other interstates in the state. Additionally, many drivers noted that more truck parking is needed on many of the U.S. highways and other non-interstate freeways. Suggested locations include:

- On U.S. 36, which travels east to west along the northern part of the state;
- On U.S. 54, in and west of the Lake of the Ozarks area until it reaches the border with Kansas;
- On U.S. 67, which runs from St. Louis to Little Rock, Ark. There is no truck parking on this route in Missouri until drivers reach Arkansas.
- On U.S. 61, north of St. Louis until it intersects with U.S. 218 and the border with Iowa. Drivers noted that there is a rest area near Hannibal that is frequently closed at night or for the season;
- On U.S. 60, near Cabool, Mountain View and Poplar Bluffs; and
- On U.S. 63, near Willow Springs.

When developing new truck parking locations throughout the state, drivers suggested that planners consider drivers that cannot deviate from designated routes, such as those transporting hazardous materials.

## Optimal Resource Allocation

Understanding driver preferences for truck parking site amenities is a priority for MoDOT. The CS team asked the drivers which amenities were most critical to them given limited resources for maintaining rest stops and truck parking sites. Drivers were presented with the following options for investment: lighting, fences, vault toilets, trash cans, paved lots, or striped spots.

Most drivers emphasized the need for bathroom facilities as well as lighting. They noted that a lack of bathroom facilities could contribute to trucks stopping in the right-of-way even when parking spots are available. Additionally, drivers prefer full restrooms, but are open to using vault toilets that do not have a septic system, especially if they



were more available in rural areas. Drivers also noted that stopping at truck parking sites without adequate lighting can make them fear for their personal safety, and make it difficult to maneuver in and out of the facility.

Aside from lighting and bathroom facilities, drivers were more open to tradeoffs among the other truck parking infrastructure options. Drivers prefer paved lots and striped spots, especially those who are contractually bound by a “sitting duck” policy that requires them to park in designated parking spots. However, other drivers can work with unpaved lots as long as the gravel sites are well-maintained and kept level, which is important to avoid vehicle damage.

More than specific markings, drivers emphasize the importance of truck parking facility design. Truck parking sites must take into consideration the possibility that a driver will park in such a way that blocks other vehicles from exiting. For this reason, many drivers will choose a truck parking site over a rest area when given the option, as they are less likely to be blocked in at these sites. The layout of parking sites can help prevent that kind of behavior, and drivers recommended looking at the design of recreational vehicle, or RV, parking spots at rest stops in Kentucky as an example. Additionally, drivers avoid facilities with long frontage roads, as they may enter the facility only to find that there is no space available and then have to maneuver out. Drivers suggested that facilities are built in the median and are accessible to traffic in both directions.

## Communication

One element of the roundtable discussion explored how drivers typically find available truck parking sites and how MoDOT could better communicate truck parking availability with drivers. Many drivers find truck parking sites through the Trucker Path app or Google Maps and Google Reviews. Drivers generally look for parking ahead of time when they know they will need to stop. Some will use satellite imagery to get an idea of what the truck parking site looks like before deciding to stop there. Therefore, drivers suggested that MoDOT communicate available truck parking through an app or on a web application. One driver cited an app from the California Department of Transportation, Caltrans Quickmap<sup>16</sup>, as an example of an informative and user-friendly app.

Most drivers have not had a good experience with signs that display how many parking spots are available at a given truck parking site. In their experience, most such signs are located many miles away from the actual truck parking site, and available spaces are sometimes occupied by the time drivers arrive. If these signs are maintained, they should be placed close to the exit sign for the truck parking facility so drivers can be confident in the accuracy of the information.

---

<sup>16</sup> <http://quickmap.dot.ca.gov/>

## Appendix A. Publicly Owned Truck Parking Site Profiles

This appendix includes site profiles for the 45 publicly owned truck parking sites within one-half mile of the interstate system (St. Joseph Truck Parking on US 36 is not included). Each profile contains the following information:

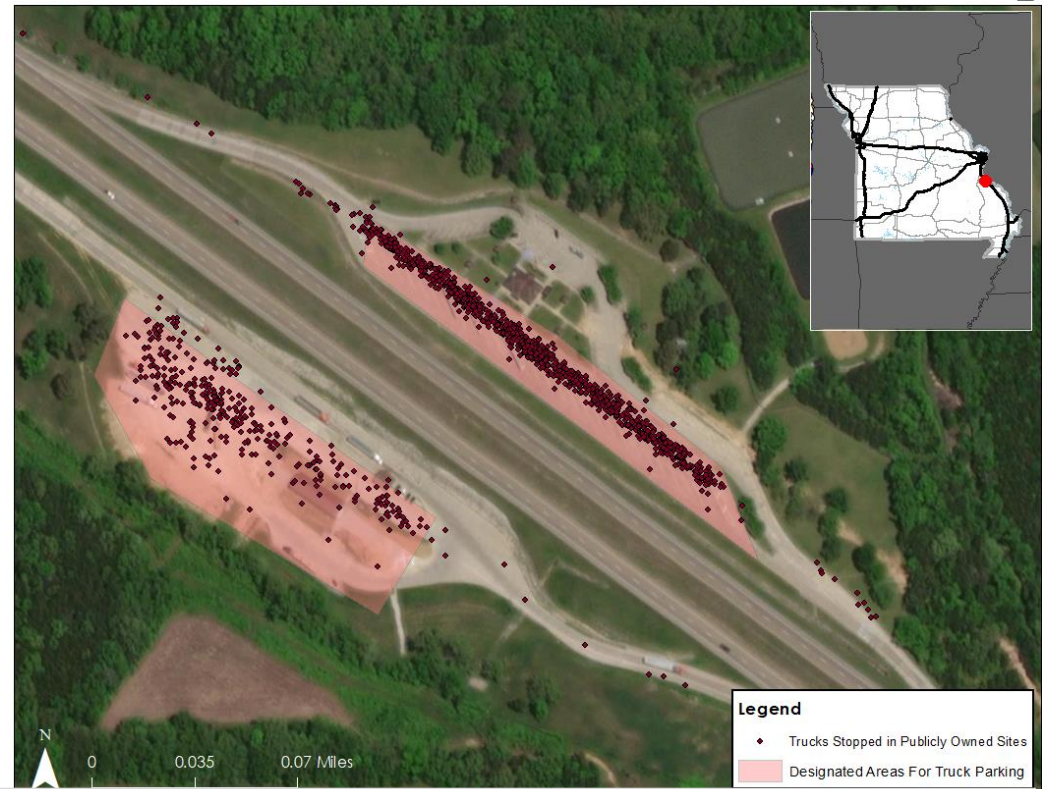
- Site Name and Direction of Travel (sites that are directly across the highway from each other are combined into a single profile).
- A table of key attributes including highway, direction, latitude/longitude, inventory, peak hour utilization and amenities.
- Aerial imagery showing striped truck parking areas (when available) and GPS pings of where trucks parked during the eight-week data collection period.
- Utilization charts showing the average number of trucks stopped at each hour of the day and site inventory (number of truck parking spaces).

## Bloomsdale Rest Area Northbound (NB) & Bloomsdale Weigh Station Southbound (SB)

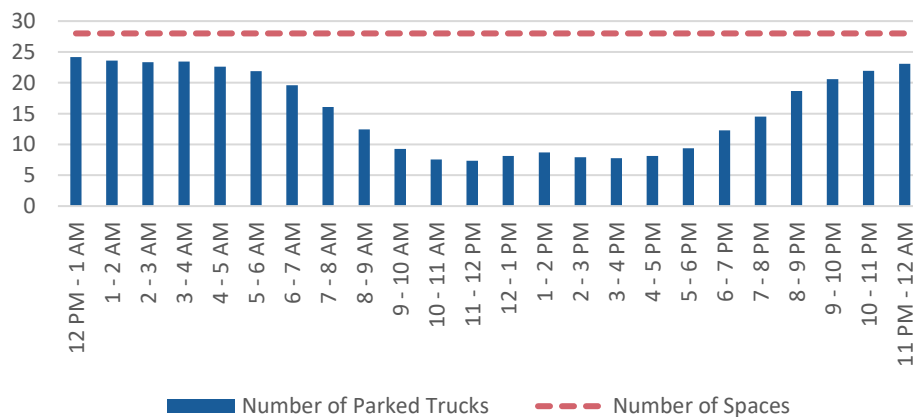
### TRUCK PARKING PROFILE

Key Attributes	
Highway & Direction	I-55 NB & SB
County	Ste. Genevieve
Latitude, Longitude	38.030948, -90.248675; 38.0306, -90.250488
Inventory (Number of Spaces)	28 NB; 15 SB
Statewide Peak Hour (2-3 AM) Utilization	83% NB; 67% SB
Restrooms	Yes NB; No SB
Lighting	Yes NB; No SB
Trash Cans	Yes NB; No SB
Striped Parking	Yes NB; No SB
Angled Parking	Yes NB; No SB
Vending Machine	Yes NB; No SB
Pet/Picnic Area	Yes NB; No SB

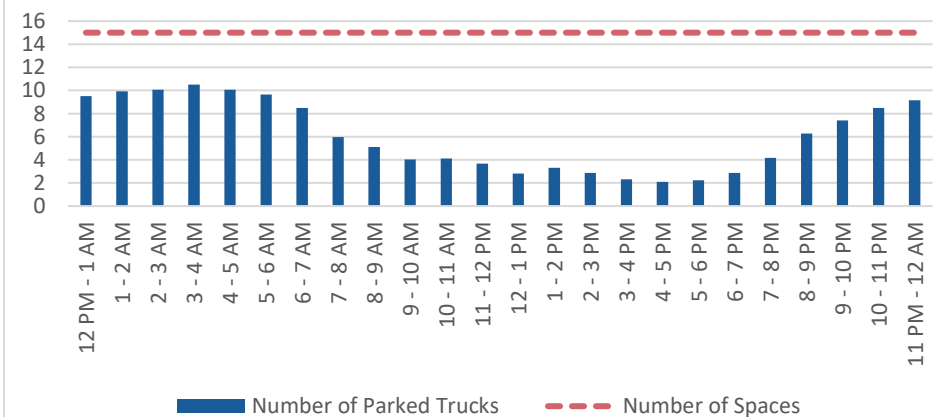
Note: Bloomsdale Weigh Station SB no longer allows truck parking as of November 2020.



Utilization by Hour of Day - Bloomsdale Rest Area NB



Utilization by Hour of Day - Bloomsdale Weigh Station SB

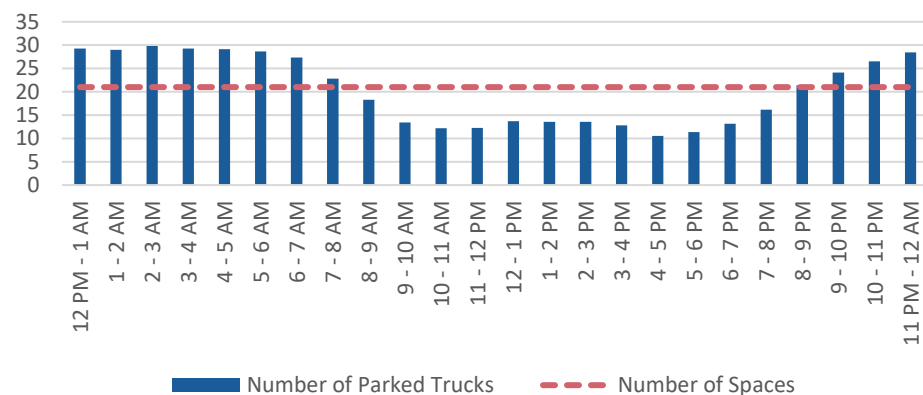


# Boonville Rest Area Eastbound (EB) & Westbound (WB)

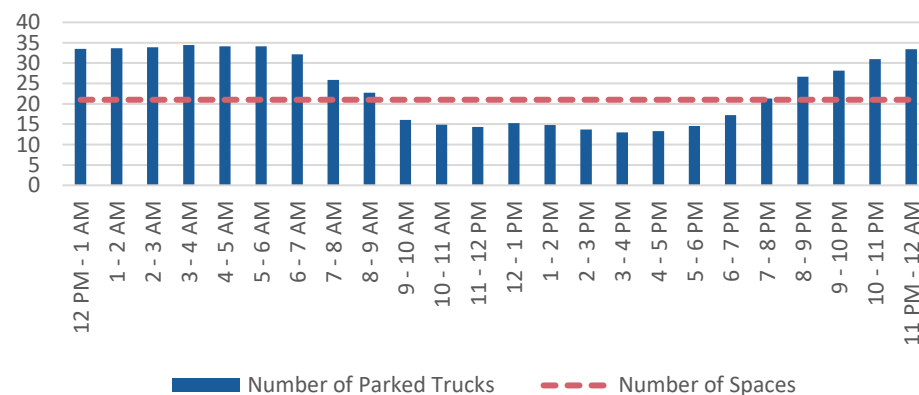
Key Attributes	
Highway & Direction	I-70 EB & WB
County	Cooper
Latitude, Longitude	38.936488, -92.726698; 38.937277, -93.729509
Inventory (Number of Spaces)	21 EB; 21 WB
Statewide Peak Hour (2-3 AM) Utilization	142% EB; 161% WB
Restrooms	Yes EB; Yes WB
Lighting	Yes EB; Yes WB
Trash Cans	Yes EB; Yes WB
Striped Parking	Yes EB; Yes WB
Angled Parking	Yes EB; Yes WB
Vending Machine	Yes EB; Yes WB
Pet/Picnic Area	Yes EB; Yes WB



Utilization by Hour of Day - Boonville Rest Area EB



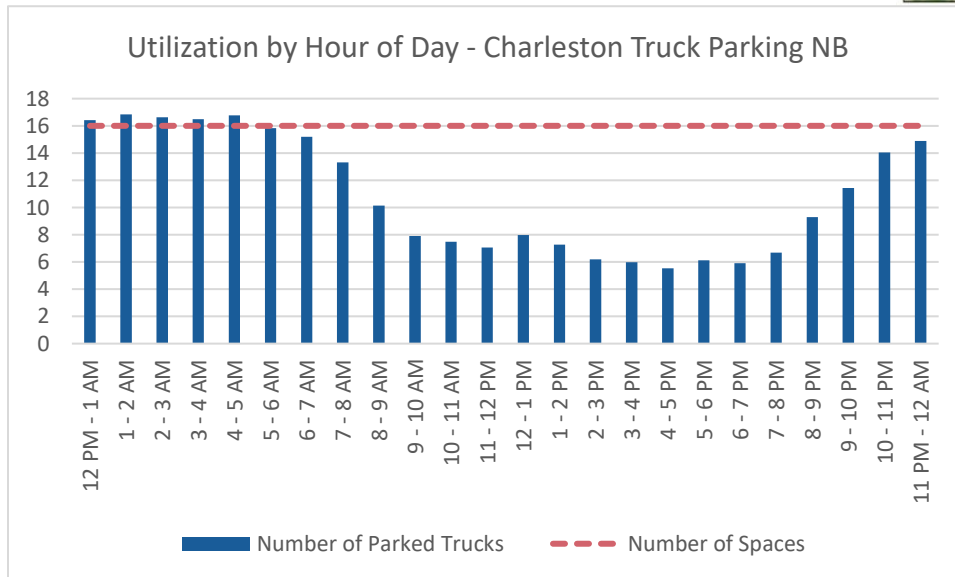
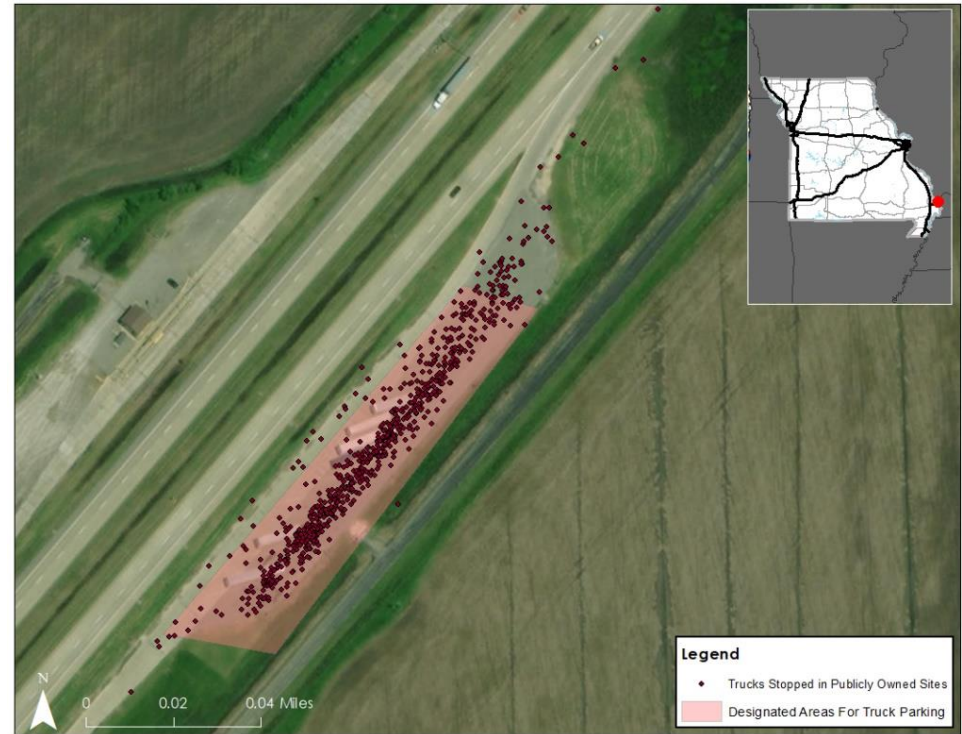
Utilization by Hour of Day - Boonville Rest Area WB





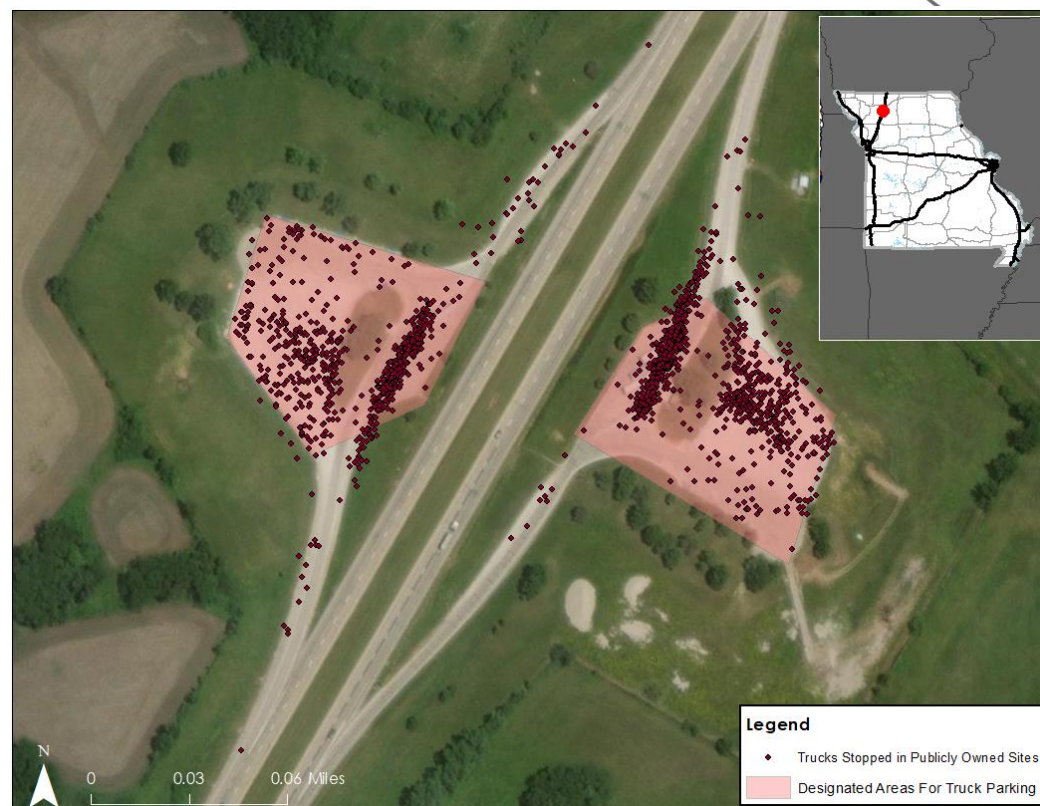
Charleston Truck Parking Area Northbound (NB)

Key Attributes	
Highway & Direction	I-57 NB
County	Mississippi
Latitude, Longitude	36.981352, -89.248359;
Inventory (Number of Spaces)	16
Statewide Peak Hour (2-3 AM) Utilization	104%
Restrooms	No
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	No
Pet/Picnic Area	No

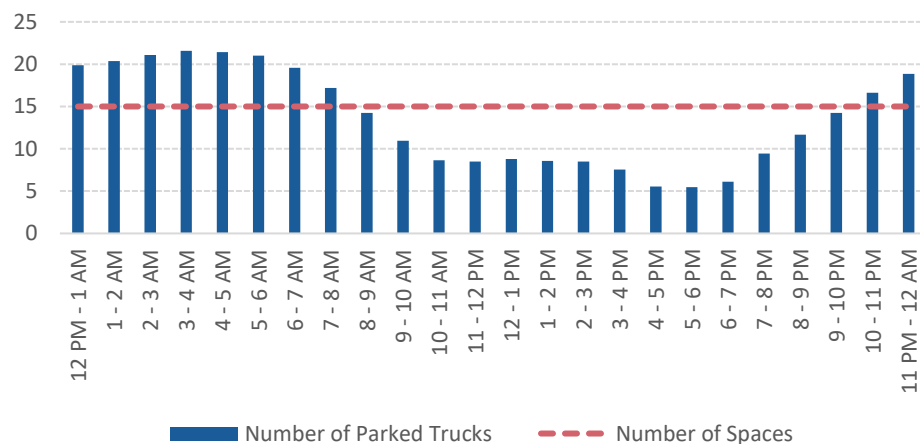


## Coffey Truck Parking Area Northbound (NB) &amp; Southbound (SB)

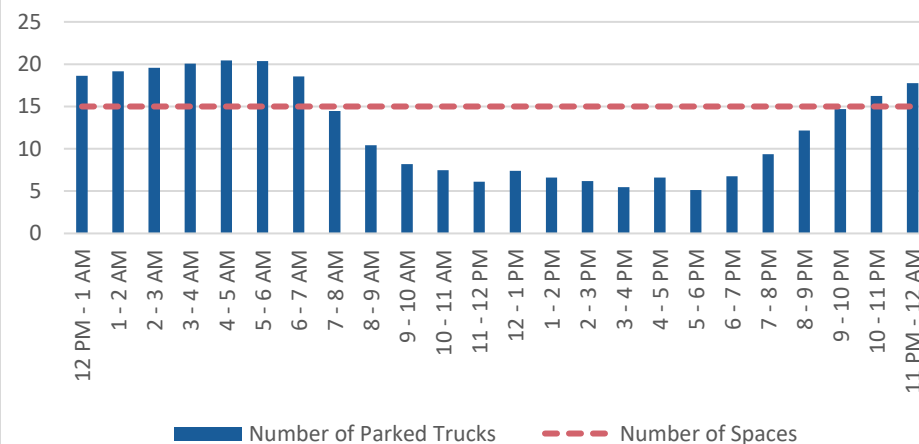
Key Attributes	
Highway & Direction	I-35 NB & SB
County	Daviess
Latitude, Longitude	40.116523, -94.060707; 40.116666, -94.06215
Inventory (Number of Spaces)	15 NB; 15 SB
Statewide Peak Hour (2-3 AM) Utilization	141% NB; 130% SB
Restrooms	Vault NB; Vault SB
Lighting	Yes NB; Yes SB
Trash Cans	No NB; No SB
Striped Parking	Yes NB; Yes SB
Angled Parking	Yes NB; Yes SB
Vending Machine	No NB; No SB
Pet/Picnic Area	No NB; No SB



Utilization by Hour of Day - Coffee Truck Parking NB



Utilization by Hour of Day - Coffee Truck Parking SB





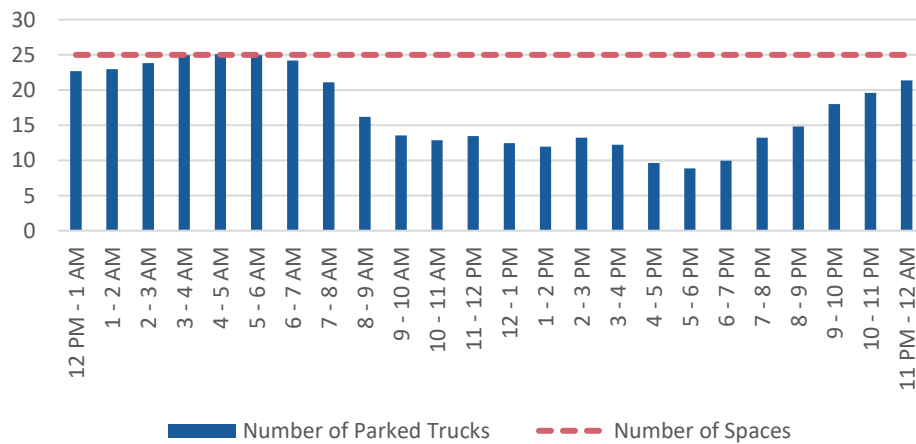
## TRUCK PARKING PROFILE

### Concordia Rest Area Eastbound (EB) & Westbound (WB)

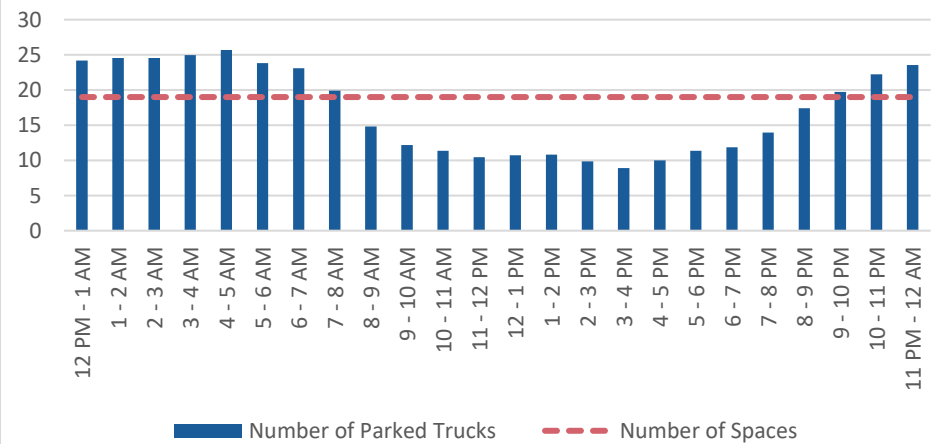
Key Attributes	
Highway & Direction	I-70 EB & WB
County	Lafayette
Latitude, Longitude	38.993137, -93.586684; 38.994043, -93.586756
Inventory (Number of Spaces)	25 EB; 19 WB
Statewide Peak Hour (2-3 AM) Utilization	95% EB; 129% WB
Restrooms	Yes EB; Yes WB
Lighting	Yes EB; Yes WB
Trash Cans	Yes EB; Yes WB
Striped Parking	Yes EB; Yes WB
Angled Parking	Yes EB; Yes WB
Vending Machine	Yes EB; Yes WB
Pet/Picnic Area	Yes EB; Yes WB



Utilization by Hour of Day - Concordia Rest Area EB

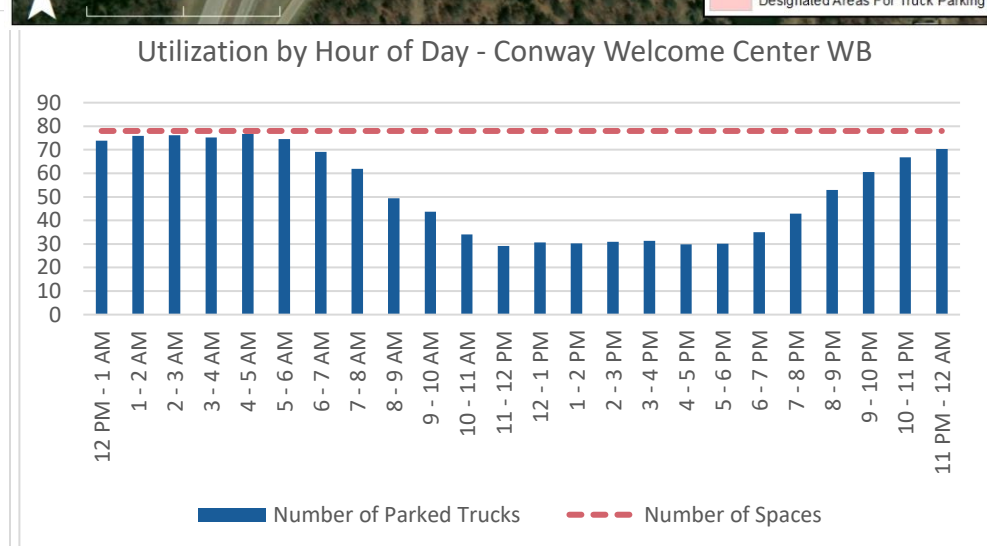
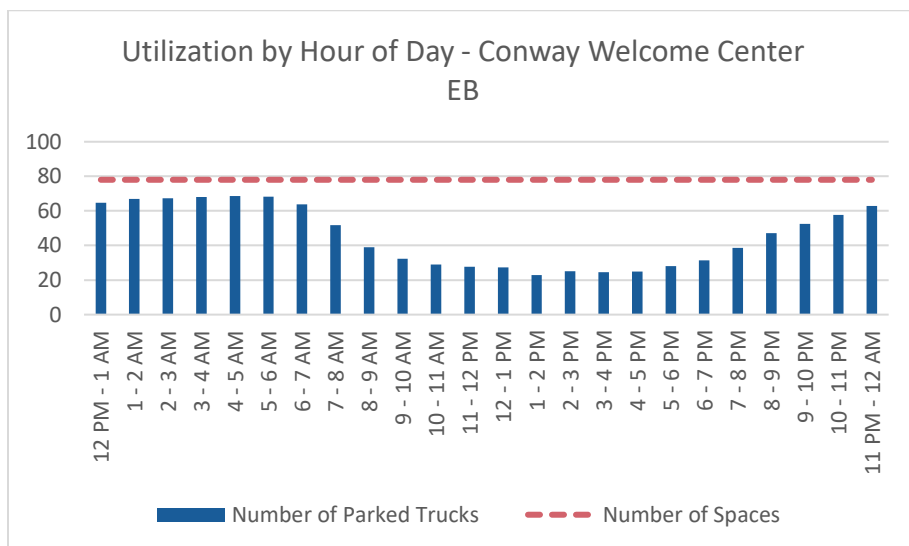
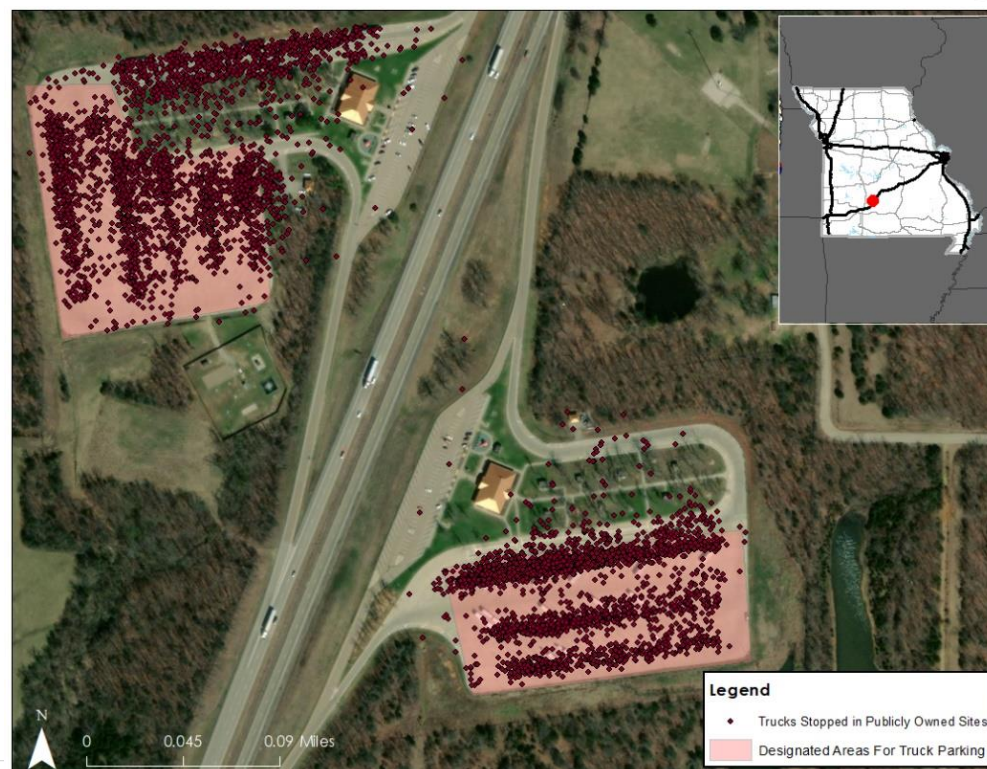


Utilization by Hour of Day - Concordia Rest Area WB



# Conway Welcome Center Eastbound (EB) & Westbound (WB)

Key Attributes	
Highway & Direction	I-44 EB & WB
County	Webster
Latitude, Longitude	37.472, -92.855647; 37.474523, -92.859621
Inventory (Number of Spaces)	78 EB; 78 WB
Statewide Peak Hour (2-3 AM) Utilization	86% EB; 98% WB
Restrooms	Yes EB: Yes WB
Lighting	Yes EB: Yes WB
Trash Cans	Yes EB: Yes WB
Striped Parking	Yes EB: Yes WB
Angled Parking	Yes EB: Yes WB
Vending Machine	Yes EB: Yes WB
Pet/Picnic Area	Yes EB: Yes WB





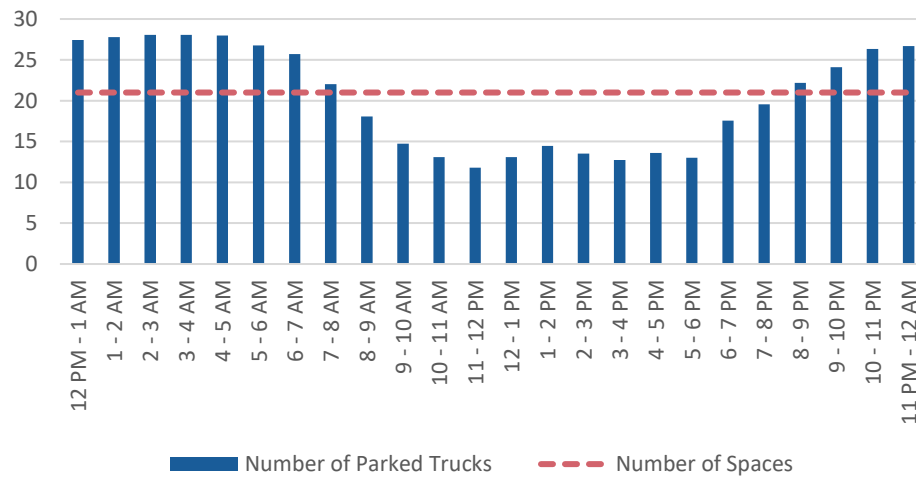
## TRUCK PARKING PROFILE

### Dearborn Rest Area Northbound (NB) & Southbound (SB)

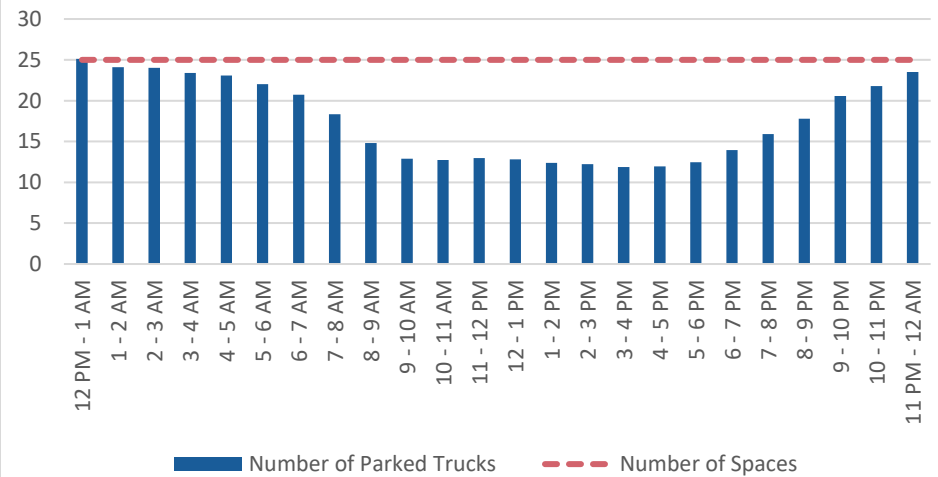
Key Attributes	
Highway & Direction	I-29 SB & NB
County	Platte
Latitude, Longitude	39.476227, -94.787831; 39.476335, -94.78683
Inventory (Number of Spaces)	25 SB; 21 NB
Statewide Peak Hour (2-3 AM) Utilization	96% SB; 134% NB
Restrooms	Yes SB; Yes NB
Lighting	Yes SB; Yes NB
Trash Cans	Yes SB; Yes NB
Striped Parking	Yes SB; Yes NB
Angled Parking	Yes SB; Yes NB
Vending Machine	Yes SB; Yes NB
Pet/Picnic Area	Yes SB; Yes NB



Utilization by Hour of Day - Dearborn Rest Area NB



Utilization by Hour of Day - Dearborn Rest Area SB

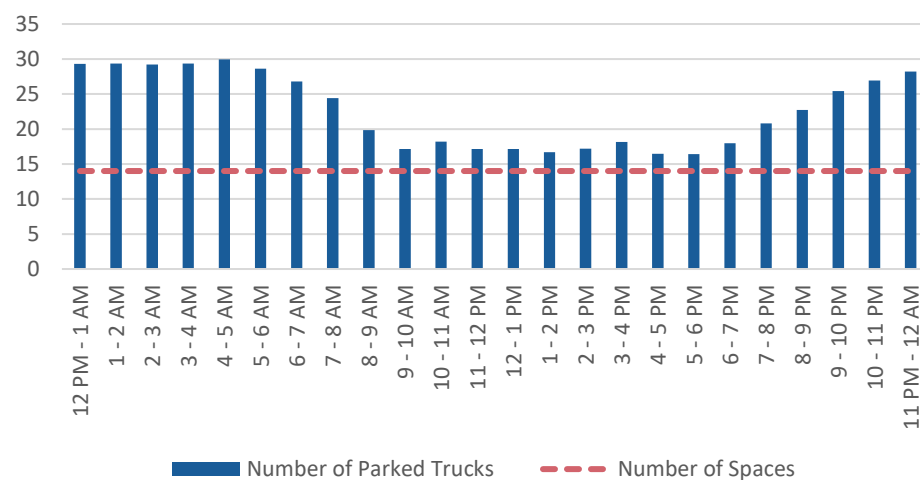


## Doolittle Truck Parking Area Eastbound (EB) &amp; Westbound (WB)

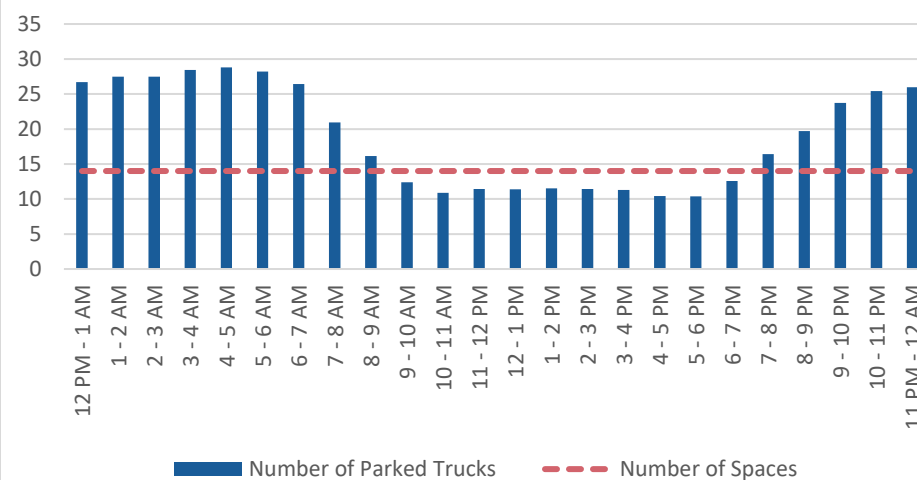
Key Attributes	
Highway & Direction	I-44 EB & WB
County	Phelps
Latitude, Longitude	37.944916, -91.909637; 37.945759, -91.909725
Inventory (Number of Spaces)	14 EB; 14 WB
Statewide Peak Hour (2-3 AM) Utilization	209% EB; 196% WB
Restrooms	Vault EB; Vault WB
Lighting	Yes EB; Yes WB
Trash Cans	Yes EB; Yes WB
Striped Parking	Yes EB; Yes WB
Angled Parking	Yes EB; Yes WB
Vending Machine	No EB; No WB
Pet/Picnic Area	No EB; No WB



Utilization by Hour of Day - Doolittle Truck Parking EB

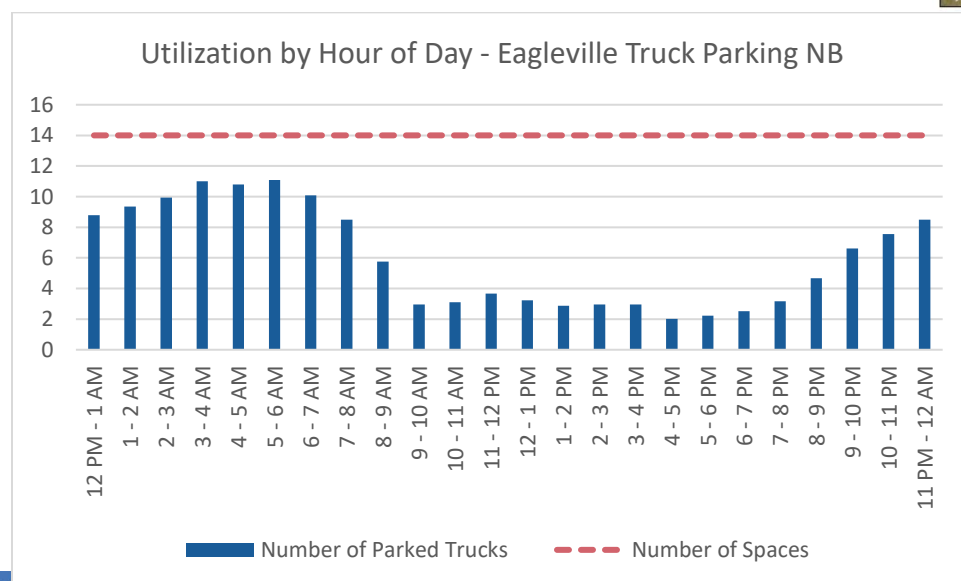


Utilization by Hour of Day - Doolittle Truck Parking WB



## Eagleville Truck Parking Area Northbound (NB)

Key Attributes	
Highway & Direction	I-35 NB
County	Harrison
Latitude, Longitude	40.521983, -93.96069
Inventory (Number of Spaces)	14
Statewide Peak Hour (2-3 AM) Utilization	71%
Restrooms	No
Lighting	Yes
Trash Cans	No
Striped Parking	No
Angled Parking	No
Vending Machine	No
Pet/Picnic Area	No



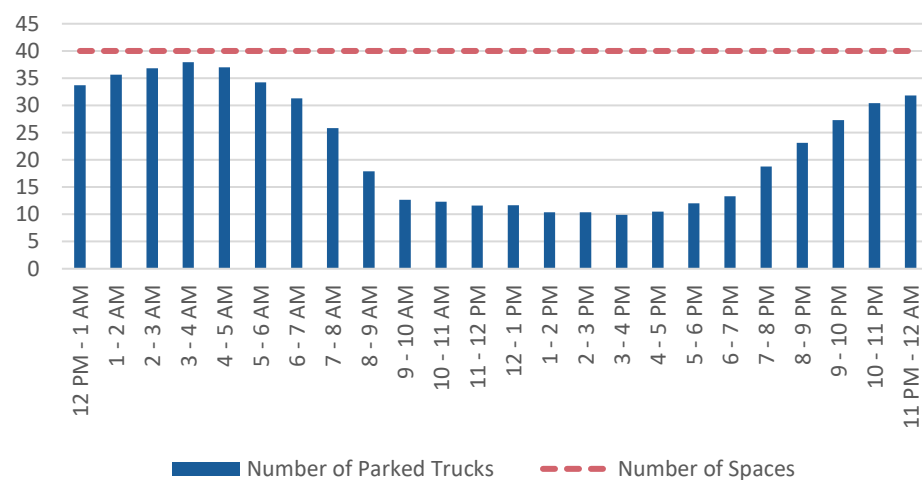


## Eagleville Welcome Center Southbound (SB)

Key Attributes	
Highway & Direction	I-35 SB
County	Harrison
Latitude, Longitude	40.549843, -93.954405
Inventory (Number of Spaces)	40
Statewide Peak Hour (2-3 AM) Utilization	92%
Restrooms	Yes
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	Yes
Pet/Picnic Area	Yes



Utilization by Hour of Day - Eagleville Welcome Center SB

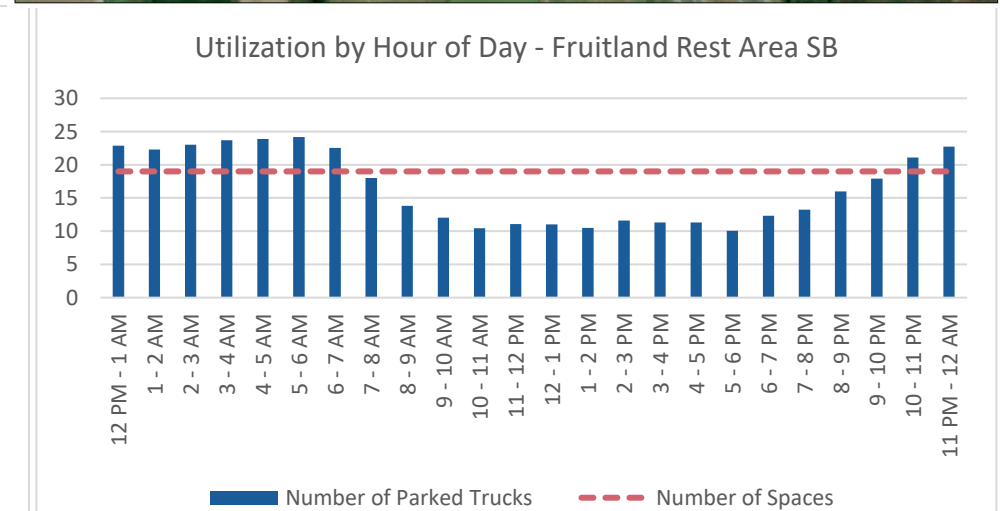
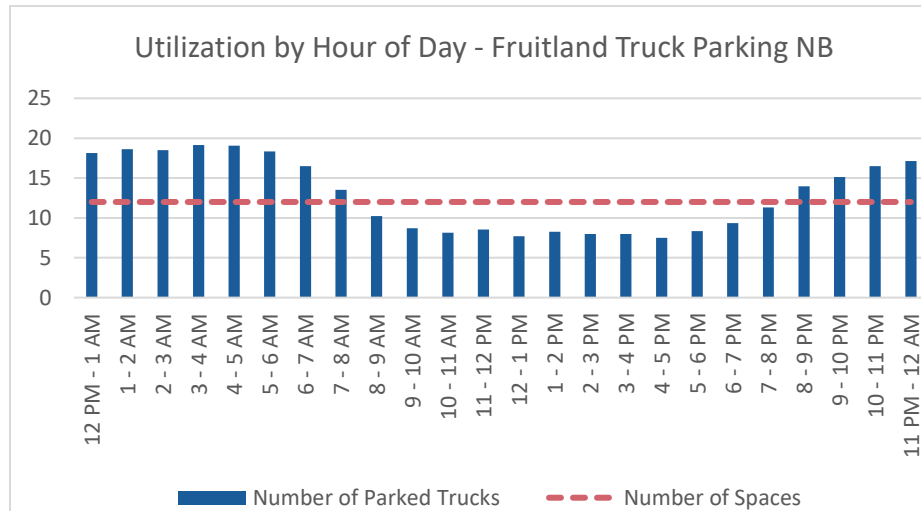
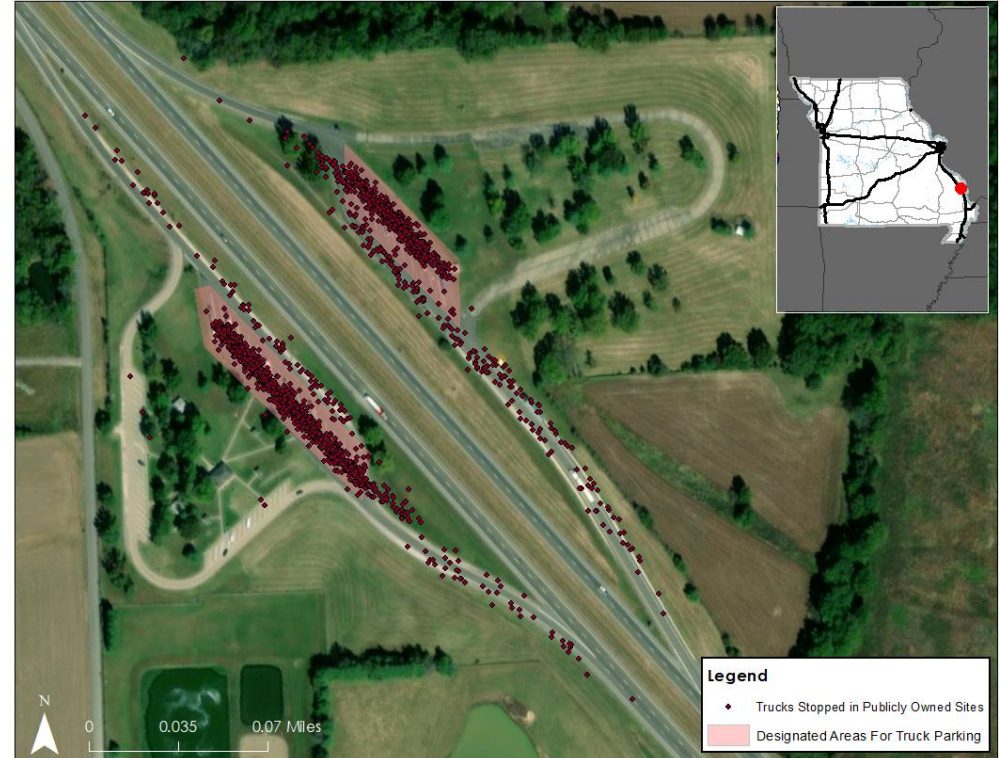




## TRUCK PARKING PROFILE

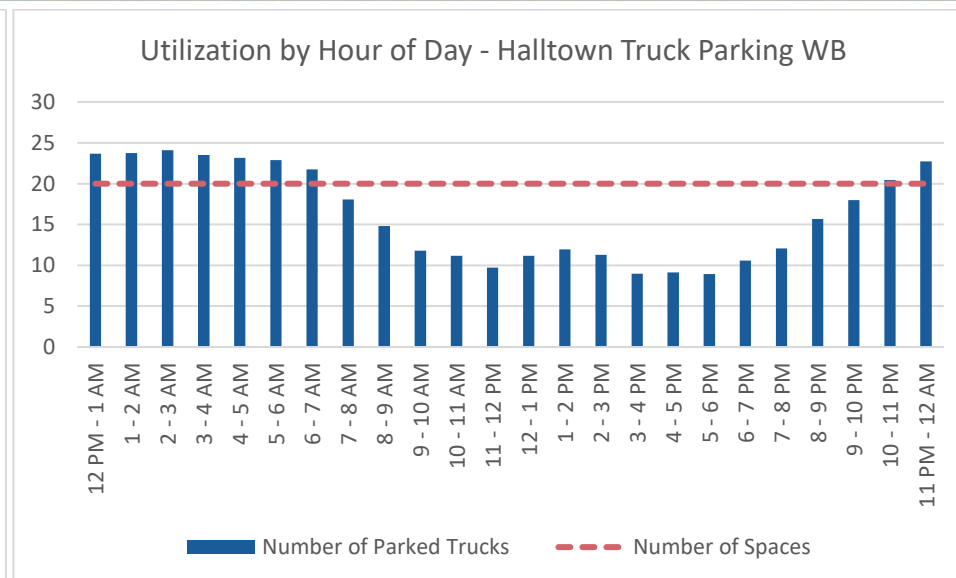
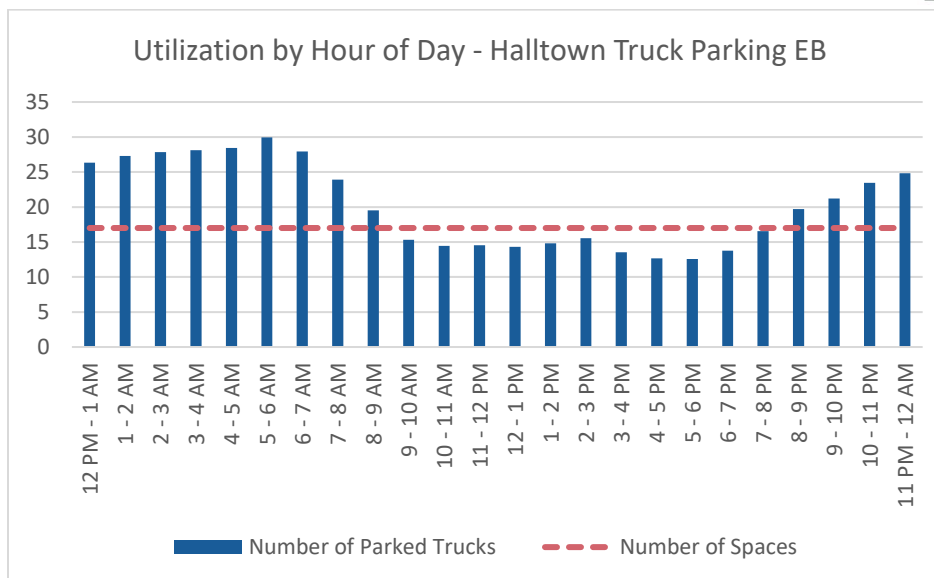
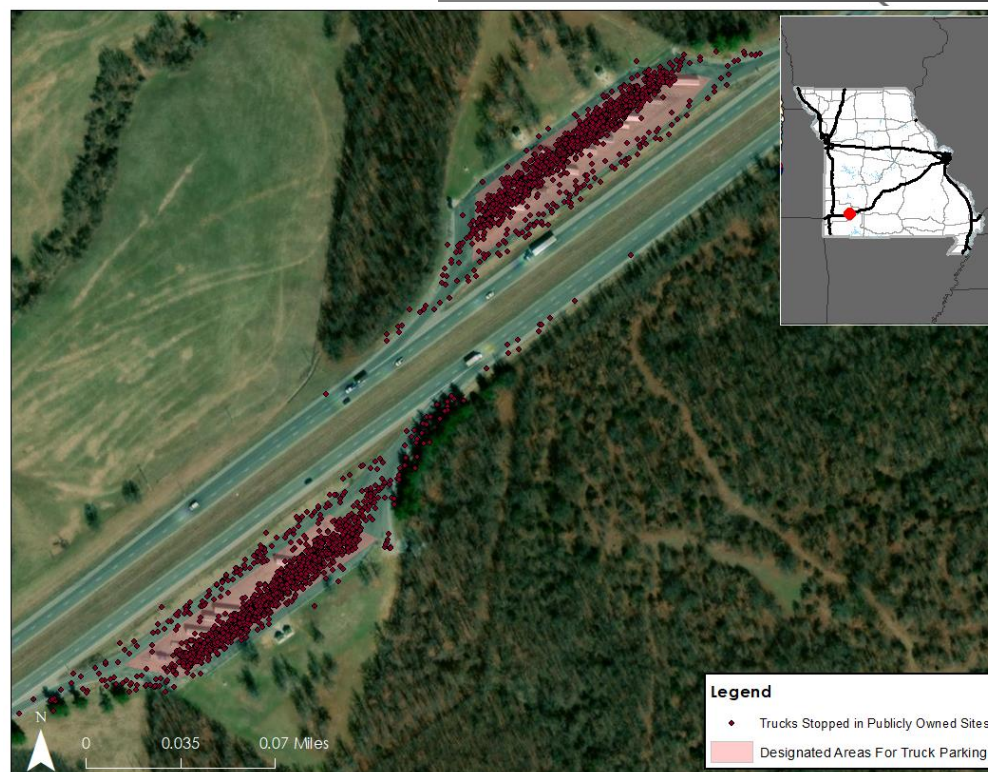
### Fruitland Truck Parking Area Northbound (NB) & Rest Area Southbound (SB)

Key Attributes	
Highway & Direction	I-55 SB & NB
County	Cape Girardeau
Latitude, Longitude	37.491421, -89.673326; 37.492363, -89.672569
Inventory (Number of Spaces)	19 SB; 12 NB
Statewide Peak Hour (2-3 AM) Utilization	121% SB; 154% NB
Restrooms	Yes SB; Yes NB
Lighting	Yes SB; Yes NB
Trash Cans	Yes SB; Unknown NB
Striped Parking	Yes SB; Yes NB
Angled Parking	Yes SB; Yes NB
Vending Machine	Yes SB; No NB
Pet/Picnic Area	Yes SB; No NB



# Halltown Truck Parking Area Eastbound (EB) & Westbound (WB)

Key Attributes	
Highway & Direction	I-44 EB & WB
County	Lawrence
Latitude, Longitude	37.138446, -93.7228; 37.140904, -93.720553
Inventory (Number of Spaces)	17 EB; 20 WB
Statewide Peak Hour (2-3 AM) Utilization	164% EB; 121% WB
Restrooms	Vault EB; Vault WB
Lighting	Yes EB; Yes WB
Trash Cans	Yes EB; Yes WB
Striped Parking	Yes EB; Yes WB
Angled Parking	Yes EB; Yes WB
Vending Machine	No EB; No WB
Pet/Picnic Area	No EB; No WB

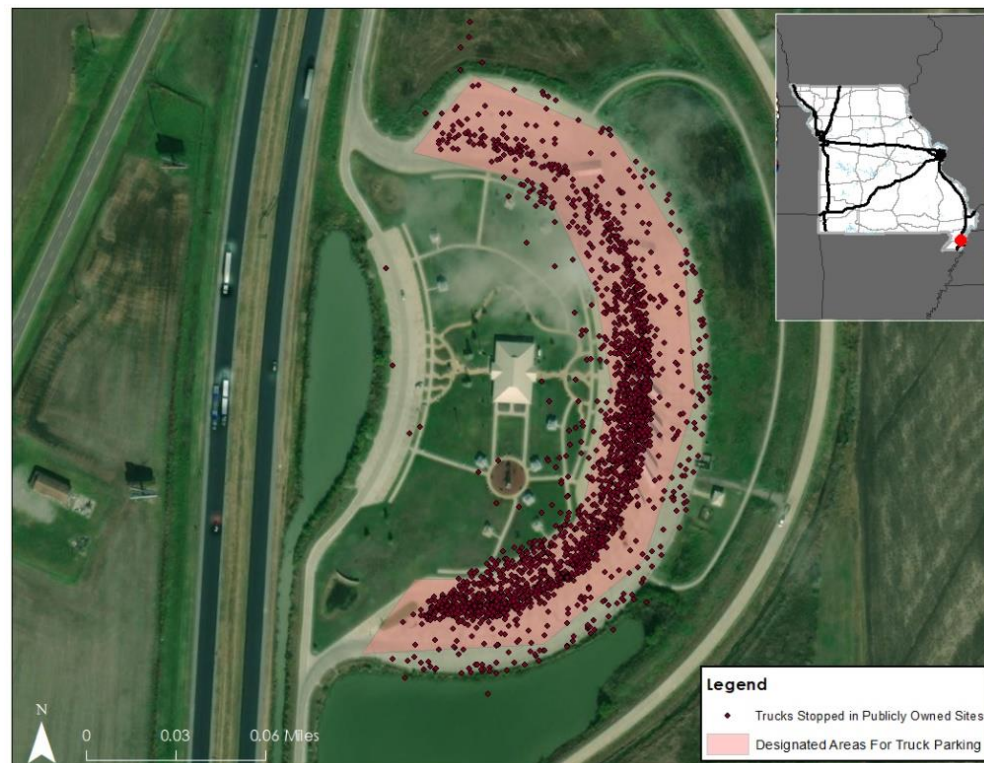




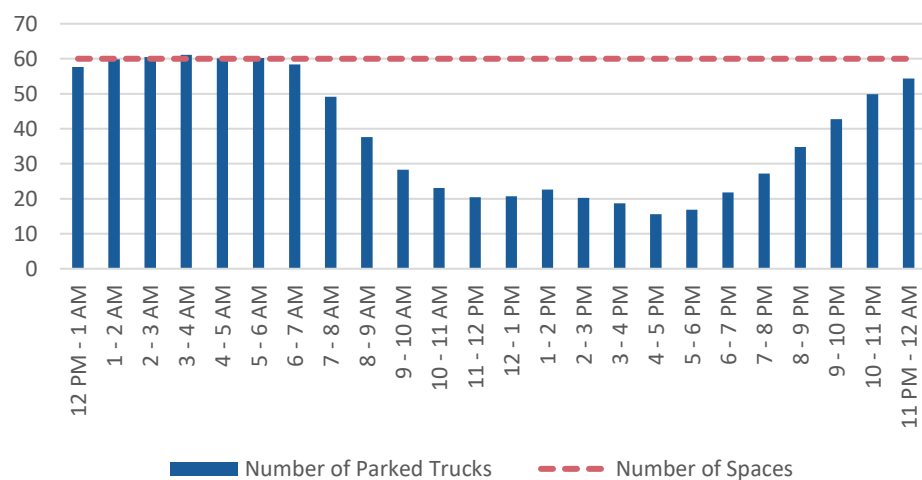
## TRUCK PARKING PROFILE

### Hayti Welcome Center Northbound (NB)

Key Attributes	
Highway & Direction	I-55 NB
County	Pemiscot
Latitude, Longitude	36.251117, -89.726427
Inventory (Number of Spaces)	60
Statewide Peak Hour (2-3 AM) Utilization	101%
Restrooms	Yes
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	Yes
Pet/Picnic Area	Yes

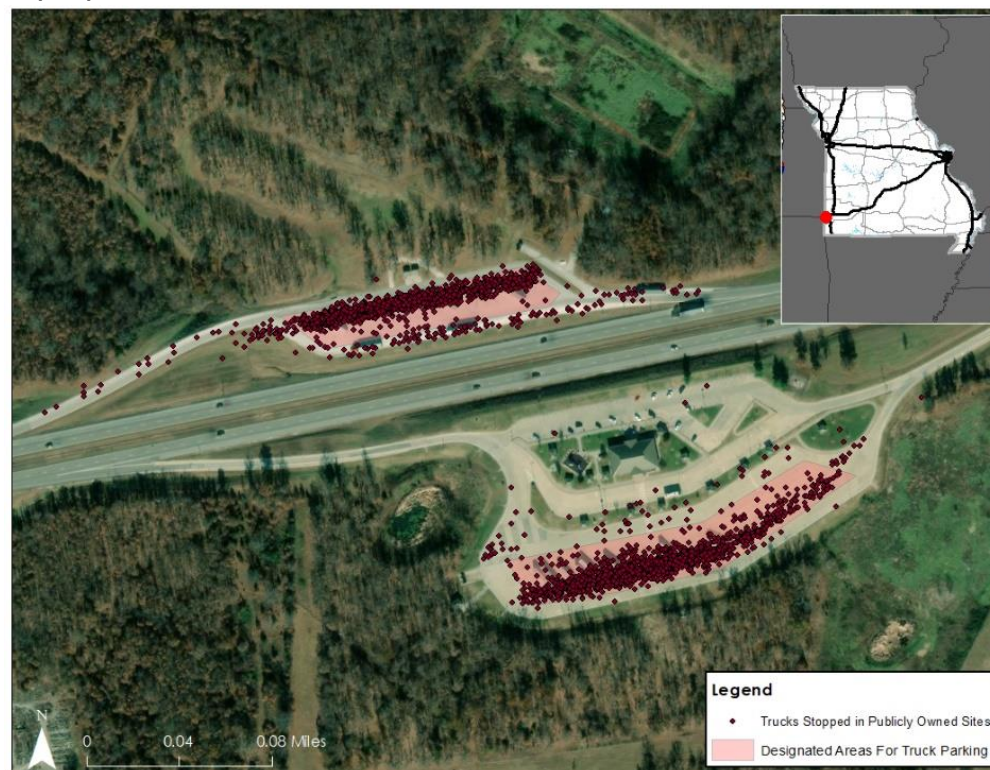


Utilization by Hour of Day - Hayti Welcome Center NB

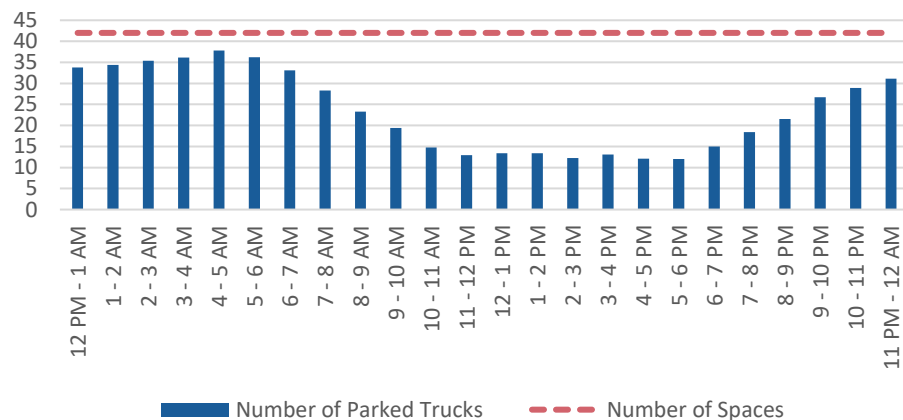


## Joplin Welcome Center Eastbound (EB) &amp; Truck Parking Area Westbound (WB)

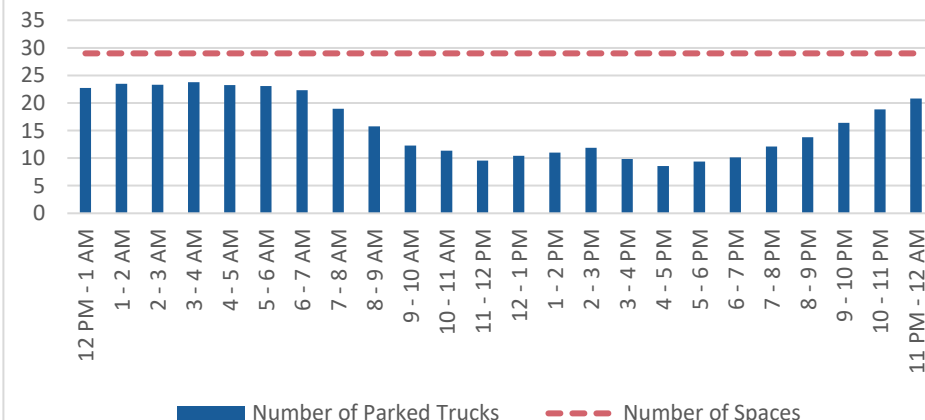
Key Attributes	
Highway & Direction	I-44 EB & WB
County	Newton
Latitude, Longitude	37.002083, -94.583822; 37.003584, -94.585704
Inventory (Number of Spaces)	42 EB; 29 WB
Statewide Peak Hour (2-3 AM) Utilization	84% EB; 80% WB
Restrooms	Yes EB; Yes WB
Lighting	Yes EB; Yes WB
Trash Cans	Yes EB; Yes WB
Striped Parking	Yes EB; Yes WB
Angled Parking	Yes EB; Yes WB
Vending Machine	Yes EB; No WB
Pet/Picnic Area	Yes EB; No WB



Utilization by Hour of Day - Joplin Welcome Center EB



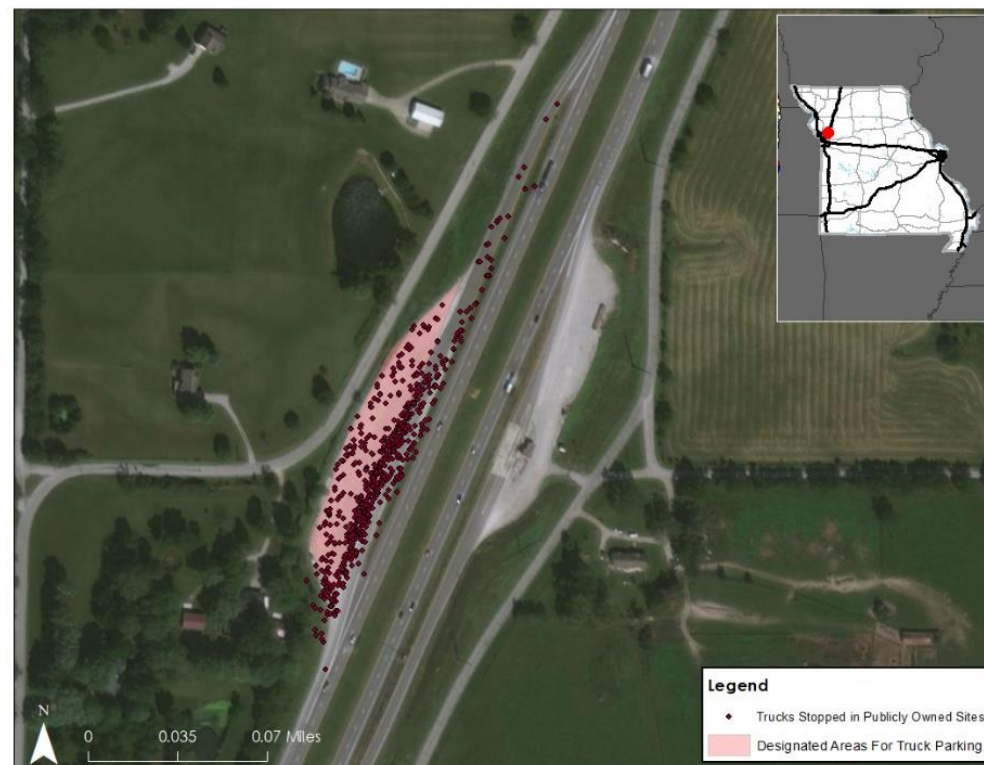
Utilization by Hour of Day - Joplin Truck Parking WB



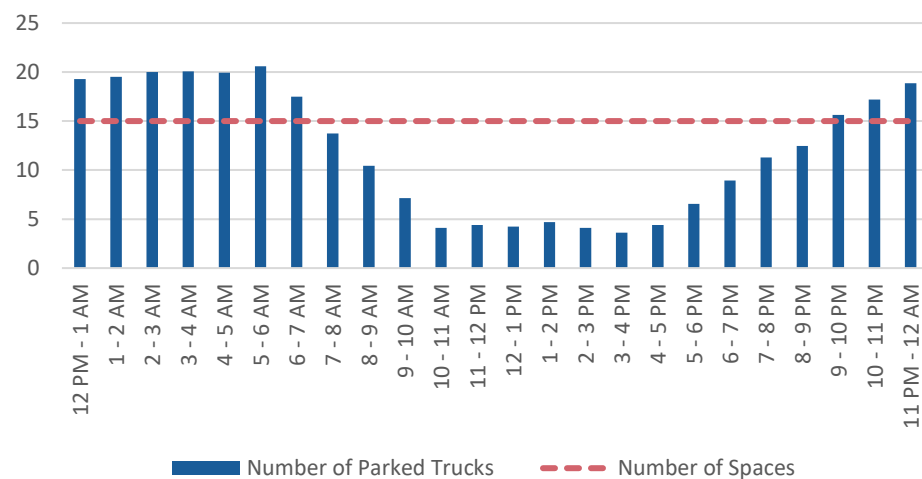
## TRUCK PARKING PROFILE

### Kearney Truck Parking Area Southbound (SB)

Key Attributes	
Highway & Direction	I-35 SB
County	Clay
Latitude, Longitude	39.317415, -94.40016
Inventory (Number of Spaces)	15
Statewide Peak Hour (2-3 AM) Utilization	133%
Restrooms	No
Lighting	Yes
Trash Cans	No
Striped Parking	No
Angled Parking	No
Vending Machine	No
Pet/Picnic Area	No



Utilization by Hour of Day - Kearney Truck Parking SB



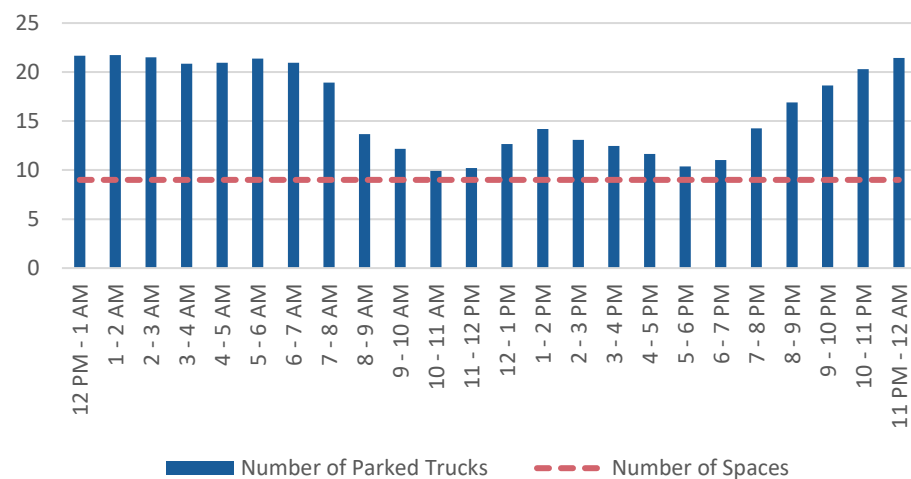


## Lathrop Rest Area Northbound (NB)

Key Attributes	
Highway & Direction	I-35 NB
County	Clinton
Latitude, Longitude	39.474689, -94.310928
Inventory (Number of Spaces)	9
Statewide Peak Hour (2-3 AM) Utilization	239%
Restrooms	Yes
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	Yes
Pet/Picnic Area	Yes



Utilization by Hour of Day - Lathrop Rest Area NB





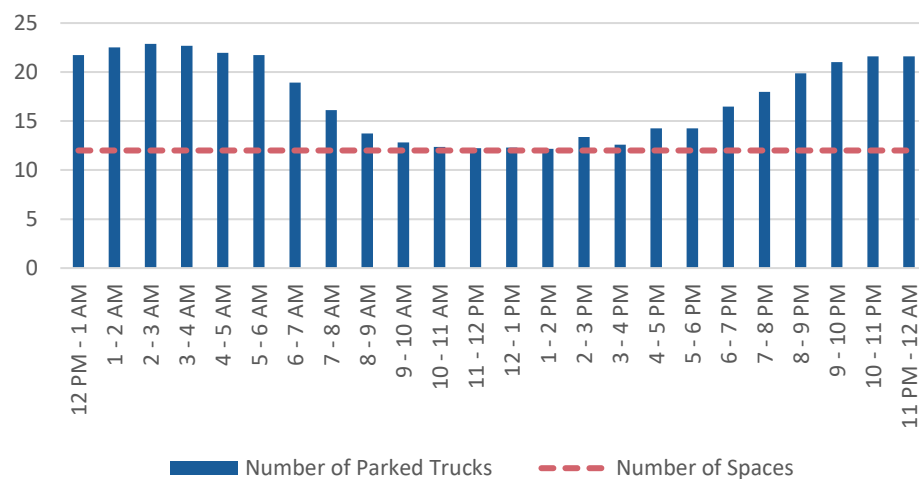
## TRUCK PARKING PROFILE

### Lathrop Rest Area Southbound (SB)

Key Attributes	
Highway & Direction	I-35 SB
County	Clinton
Latitude, Longitude	39.482432, -94.307309
Inventory (Number of Spaces)	12
Statewide Peak Hour (2-3 AM) Utilization	191%
Restrooms	Yes
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	Yes
Pet/Picnic Area	Yes



Utilization by Hour of Day - Lathrop Rest Area SB

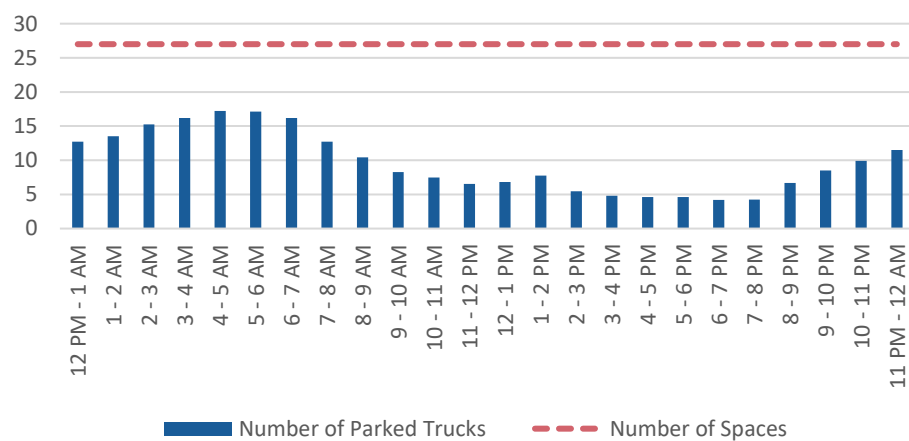


## Marston Truck Parking Area Northbound (NB) and Welcome Center Southbound (SB)

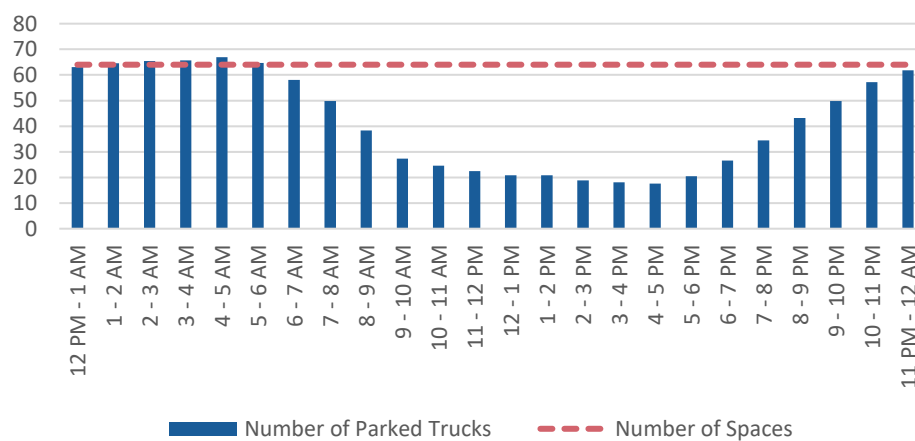
Key Attributes	
Highway & Direction	I-55 NB & SB
County	New Madrid
Latitude, Longitude	36.53742, -89.592123; 36.539506, -89.594392
Inventory (Number of Spaces)	27 NB; 64 SB
Statewide Peak Hour (2-3 AM) Utilization	57% NB; 102% SB
Restrooms	Yes NB; Yes SB
Lighting	Yes NB; Yes SB
Trash Cans	Yes NB; Yes SB
Striped Parking	Yes NB; Yes SB
Angled Parking	Yes NB; Yes SB
Vending Machine	No NB; Yes SB
Pet/Picnic Area	No NB; Yes SB



Utilization by Hour of Day - Marston Truck Parking NB



Utilization by Hour of Day - Marston Welcome Center SB

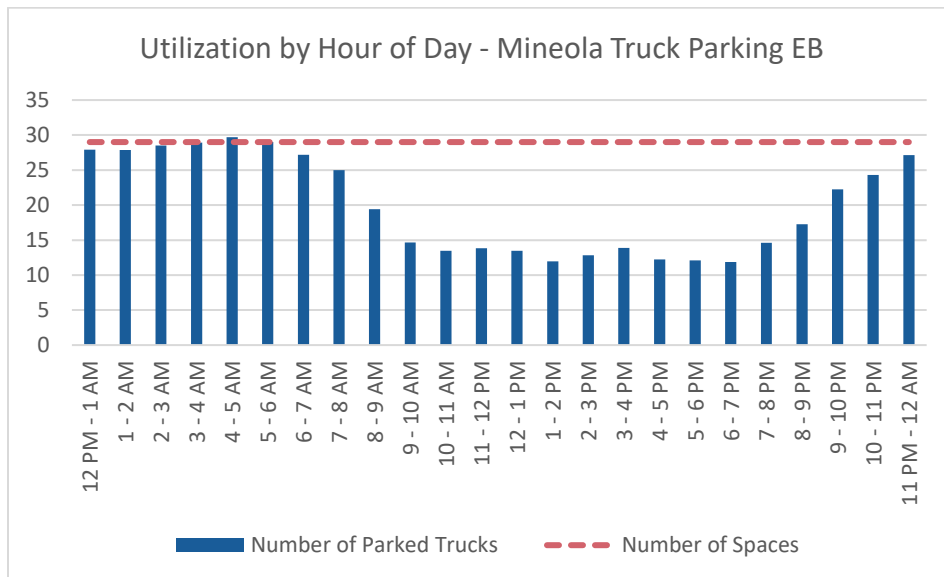
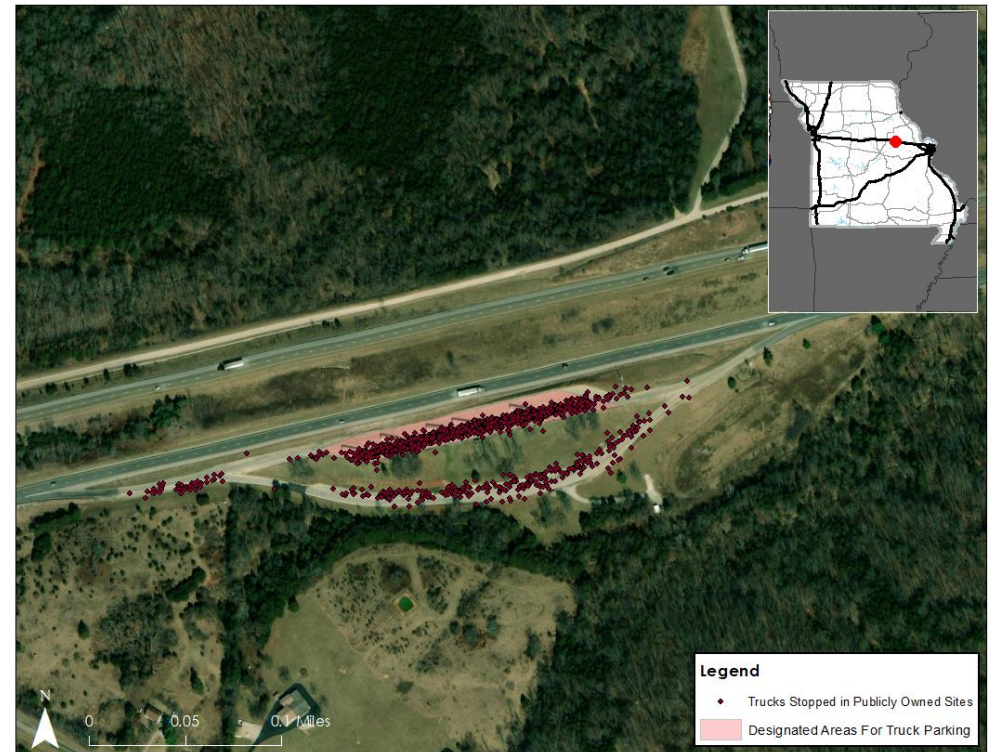




## TRUCK PARKING PROFILE

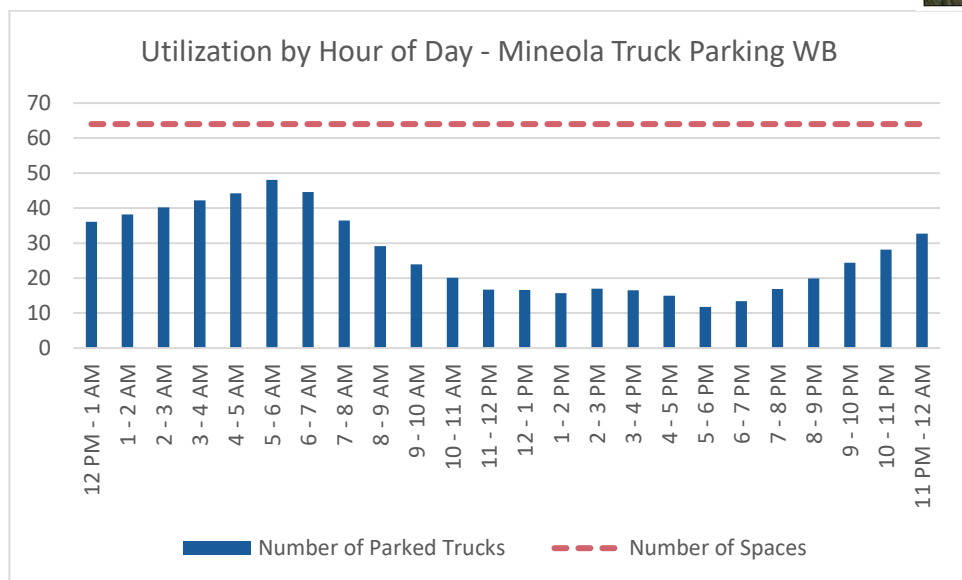
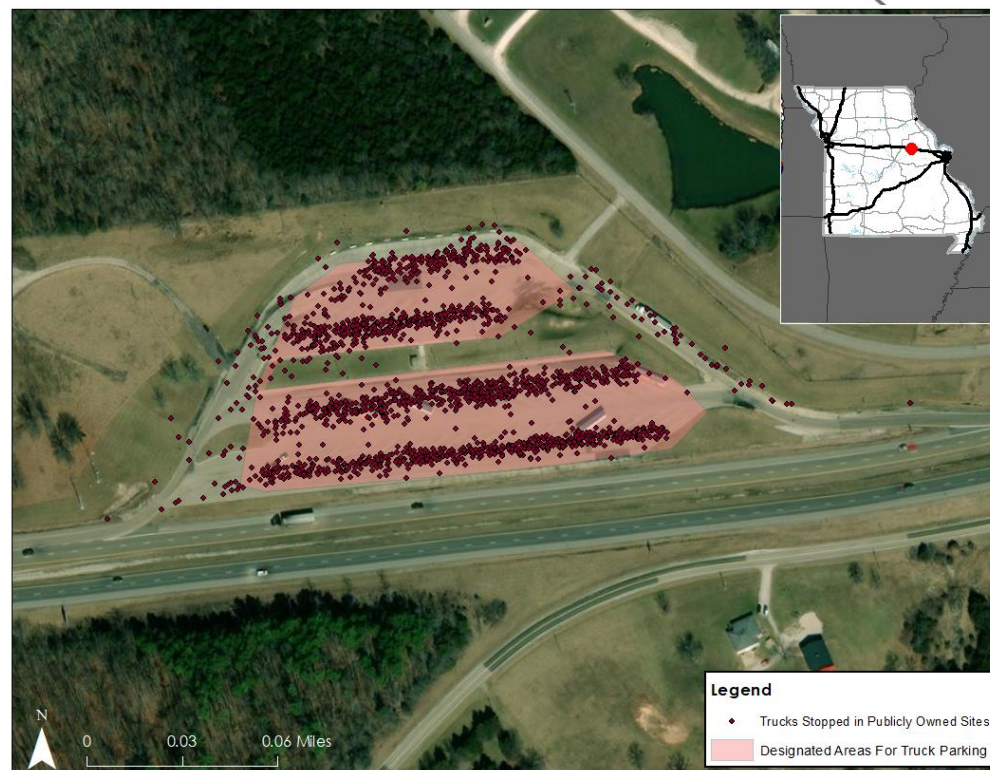
### Mineola Truck Parking Area Eastbound (EB)

Key Attributes	
Highway & Direction	I-70 EB
County	Montgomery
Latitude, Longitude	38.896955, -91.599125
Inventory (Number of Spaces)	29
Statewide Peak Hour (2-3 AM) Utilization	98%
Restrooms	Vault
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	No
Pet/Picnic Area	No



# Mineola Truck Parking Area Westbound (WB)

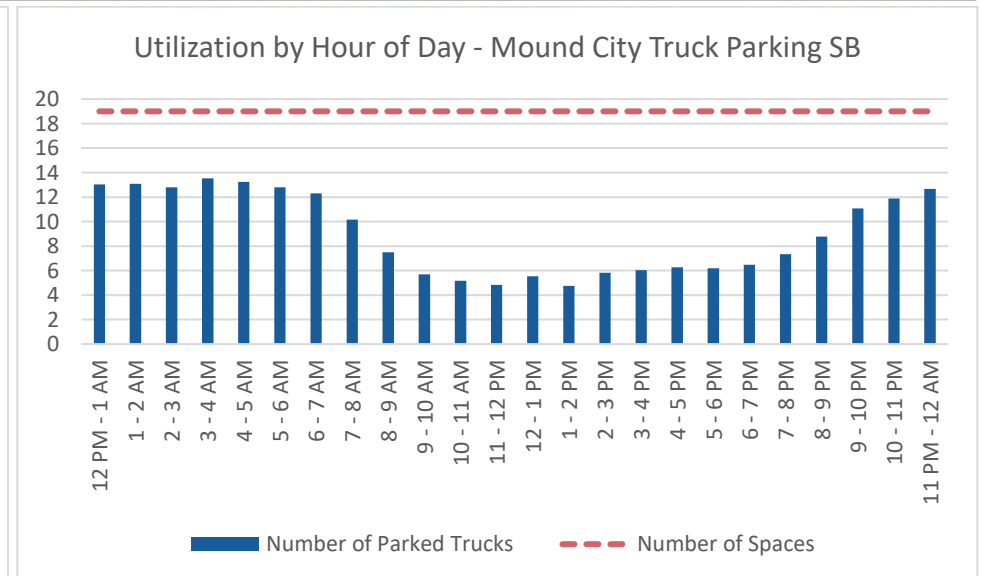
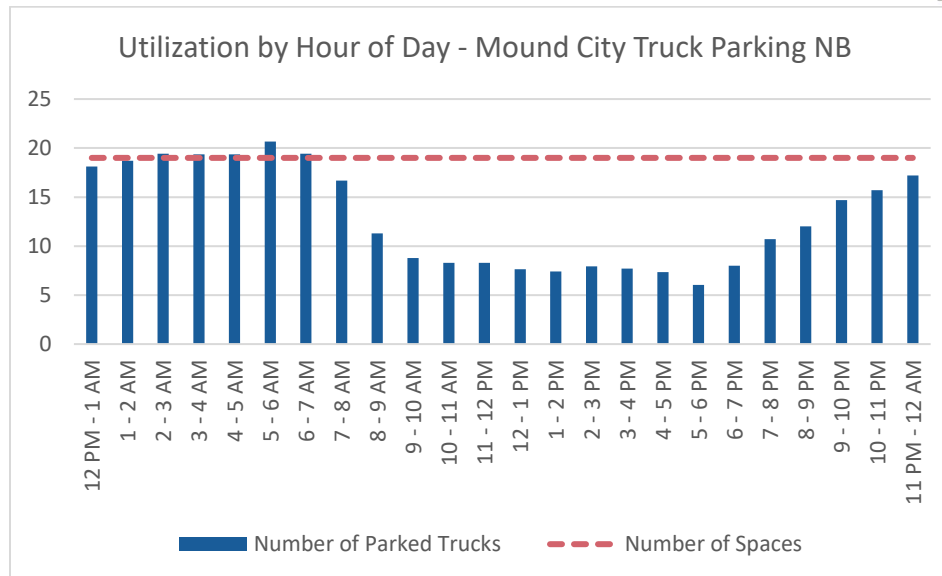
Key Attributes	
Highway & Direction	I-70 WB
County	Montgomery
Latitude, Longitude	38.90377, -91.557622
Inventory (Number of Spaces)	64
Statewide Peak Hour (2-3 AM) Utilization	63%
Restrooms	Vault
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	No
Pet/Picnic Area	No



## TRUCK PARKING PROFILE

### Mound City Truck Parking Area Northbound (NB) and Southbound (SB)

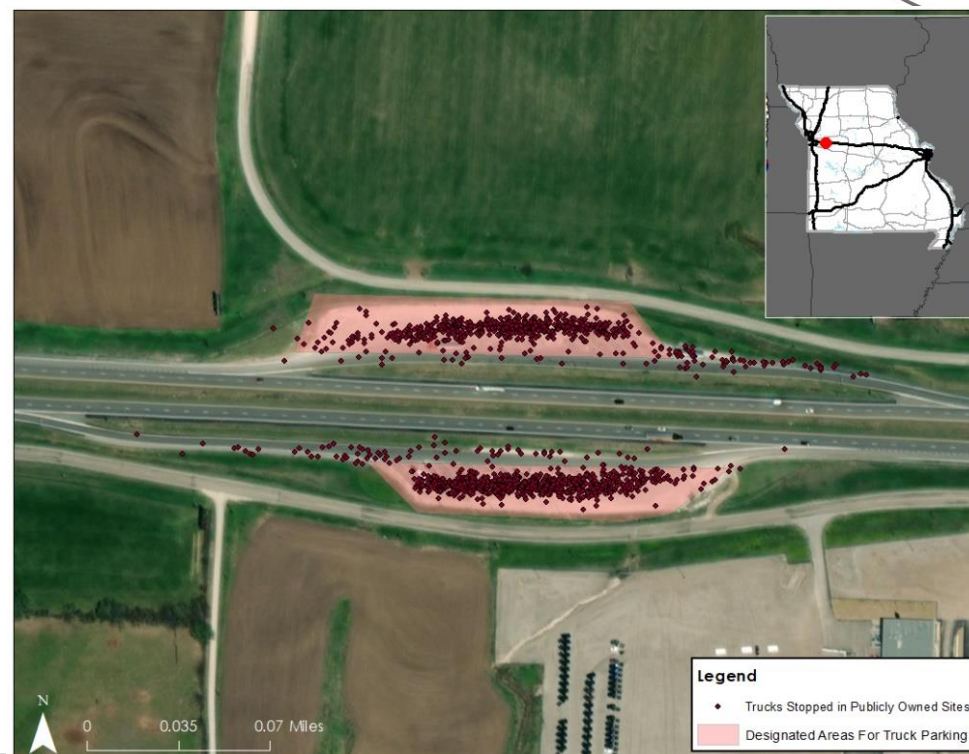
Key Attributes	
Highway & Direction	I-29 NB & SB
County	Holt
Latitude, Longitude	40.100242, -95.213407; 40.10354, -95.215454
Inventory (Number of Spaces)	19 NB; 19 SB
Statewide Peak Hour (2-3 AM) Utilization	102% NB; 67% SB
Restrooms	Vault NB; Vault SB
Lighting	Yes NB; Yes SB
Trash Cans	Yes NB; Yes SB
Striped Parking	Yes NB; Yes SB
Angled Parking	Yes NB; Yes SB
Vending Machine	No NB; No SB
Pet/Picnic Area	No NB; No SB



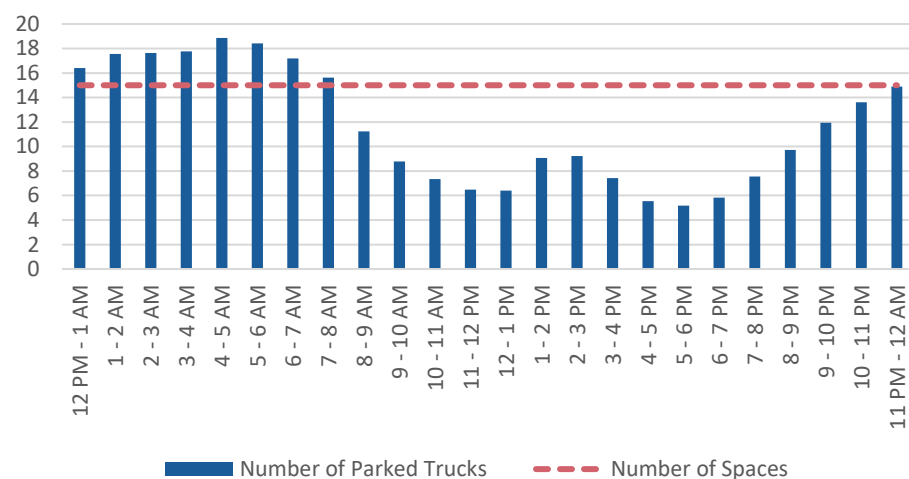


## Odessa Truck Parking Area Eastbound (EB) and Westbound (WB)

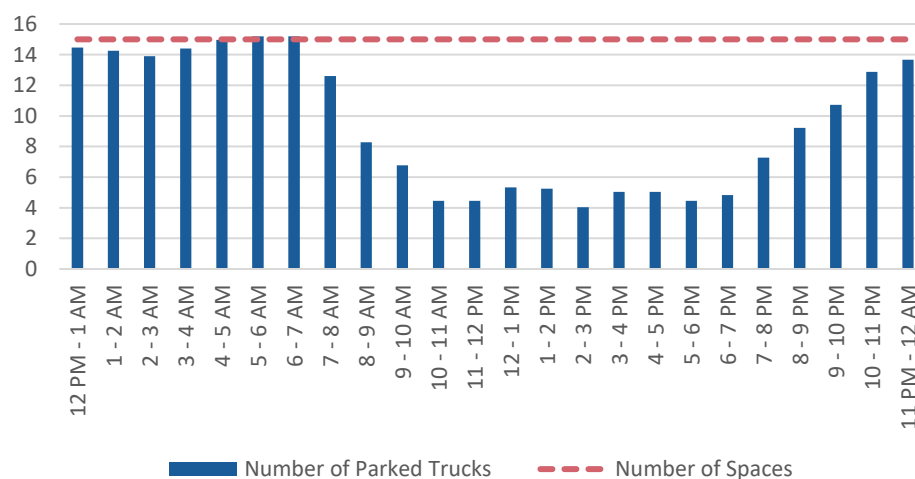
Key Attributes	
Highway & Direction	I-70 EB & WB
County	Lafayette
Latitude, Longitude	39.008946, -93.996035; 39.009756, -93.996197
Inventory (Number of Spaces)	15 NB; 15 SB
Statewide Peak Hour (2-3 AM) Utilization	118% NB; 93% SB
Restrooms	No NB; No SB
Lighting	Yes NB; Yes SB
Trash Cans	Yes NB; Yes SB
Striped Parking	Yes NB; Yes SB
Angled Parking	Yes NB; Yes SB
Vending Machine	No NB; No SB
Pet/Picnic Area	No NB; No SB



Utilization by Hour of Day - Odessa Truck Parking EB



Utilization by Hour of Day - Odessa Truck Parking WB

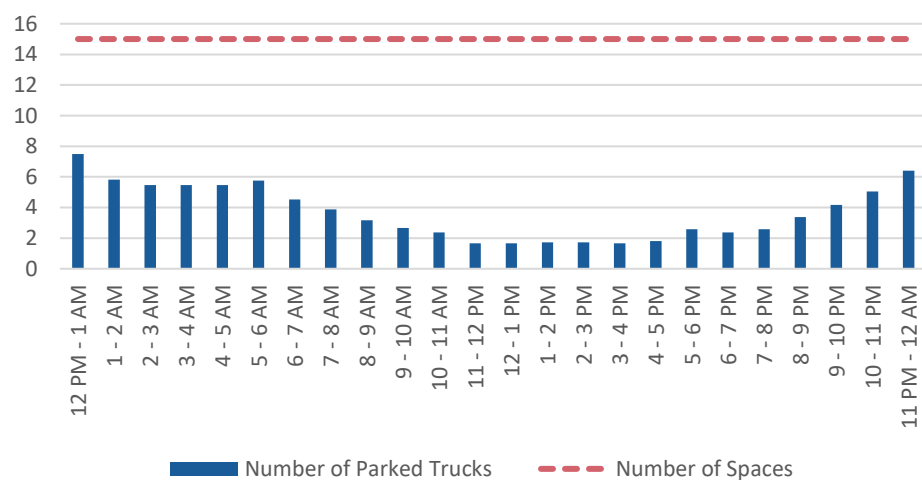


Platte City Truck Parking Area Southbound (SB)

Key Attributes	
Highway & Direction	I-29 SB
County	Platte
Latitude, Longitude	39.430345, -94.79032
Inventory (Number of Spaces)	15
Statewide Peak Hour (2-3 AM) Utilization	36%
Restrooms	No
Lighting	Yes
Trash Cans	No
Striped Parking	No
Angled Parking	No
Vending Machine	No
Pet/Picnic Area	No

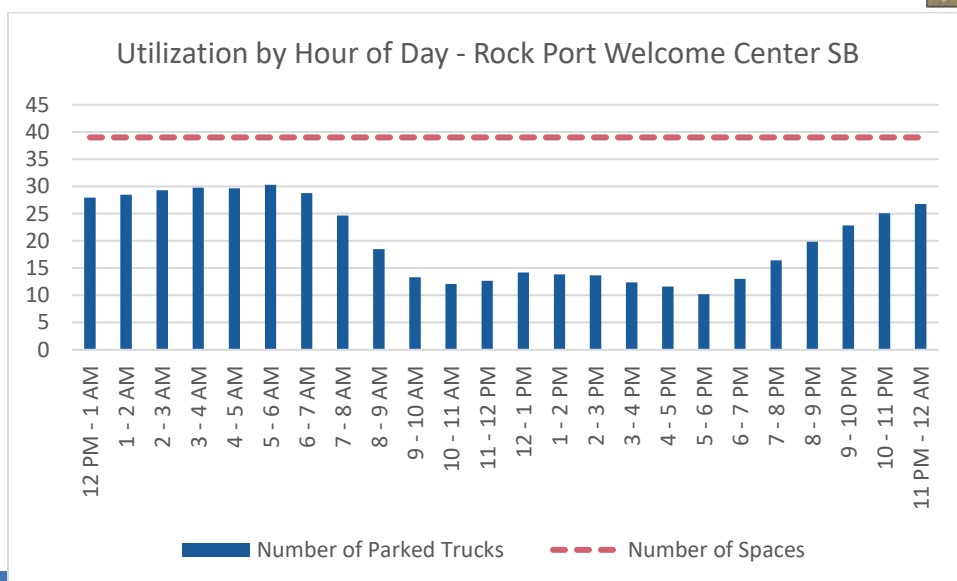


Utilization by Hour of Day - Platte City Truck Parking SB



## Rock Port Welcome Center Southbound (SB)

Key Attributes	
Highway & Direction	I-29 SB
County	Atchison
Latitude, Longitude	40.393672, -95.549632
Inventory (Number of Spaces)	39
Statewide Peak Hour (2-3 AM) Utilization	75%
Restrooms	Yes
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	Yes
Pet/Picnic Area	Yes





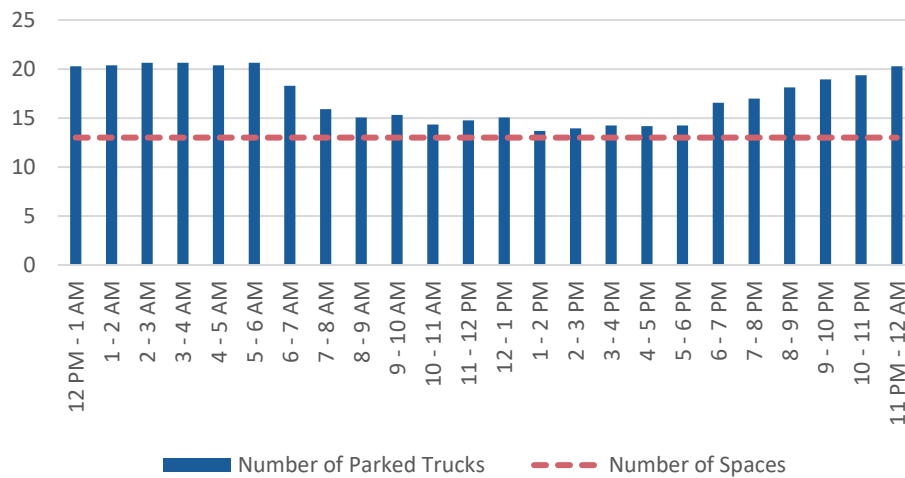
## TRUCK PARKING PROFILE

### St. Clair Rest Area Eastbound (EB) & Westbound (WB)

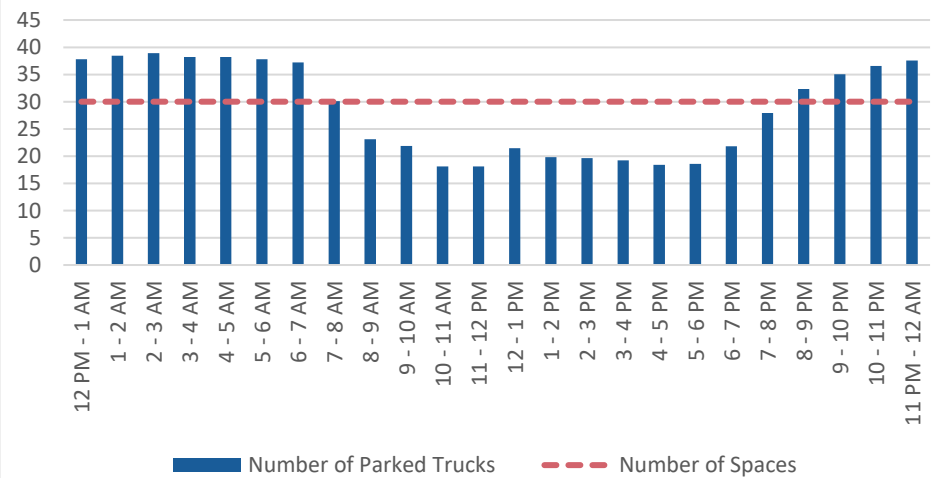
Key Attributes	
Highway & Direction	I-44 EB & WB
County	Franklin
Latitude, Longitude	38.315426, -91.048067; 38.316645, -91.045737
Inventory (Number of Spaces)	13 EB; 30 WB
Statewide Peak Hour (2-3 AM) Utilization	159% EB; 130% WB
Restrooms	Yes EB; Yes WB
Lighting	Yes EB; Yes WB
Trash Cans	Yes EB; Yes WB
Striped Parking	Yes EB; Yes WB
Angled Parking	Yes EB; Yes WB
Vending Machine	Yes EB; Yes WB
Pet/Picnic Area	Yes EB; Yes WB



Utilization by Hour of Day - St. Clair Rest Area EB



Utilization by Hour of Day - St. Clair Rest Area WB

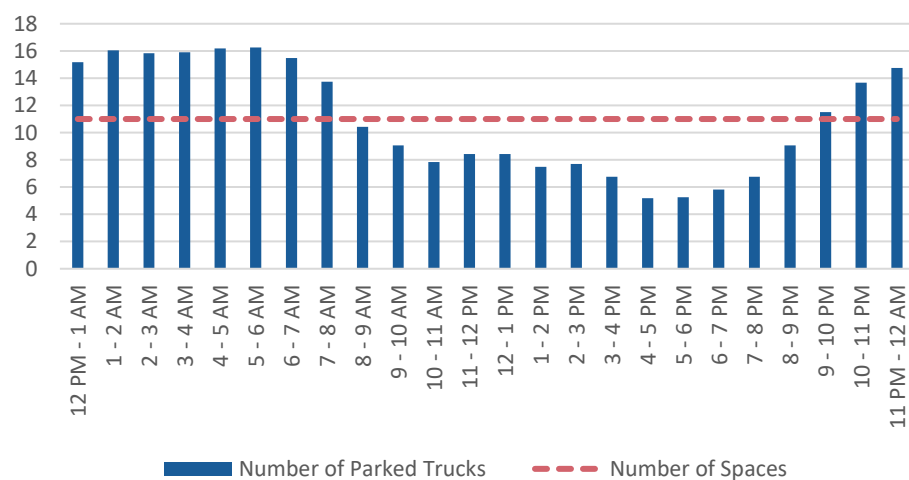


## Steele Truck Parking Area Northbound (NB) &amp; Southbound (SB)

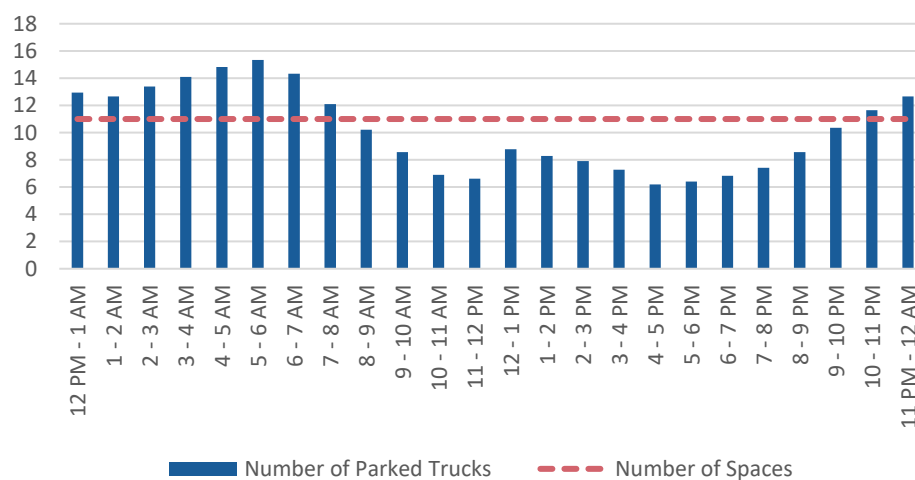
Key Attributes	
Highway & Direction	I-55 NB & SB
County	Pemiscot
Latitude, Longitude	36.035258, -89.860839
Inventory (Number of Spaces)	11 NB; 11 SB
Statewide Peak Hour (2-3 AM) Utilization	144% NB; 122% SB
Restrooms	Vault NB; Vault SB
Lighting	Yes NB; Yes SB
Trash Cans	Yes NB; Yes SB
Striped Parking	Yes NB; Yes SB
Angled Parking	Yes NB; Yes SB
Vending Machine	No SB; No NB
Pet/Picnic Area	No SB; No NB



Utilization by Hour of Day - Steele Truck Parking NB



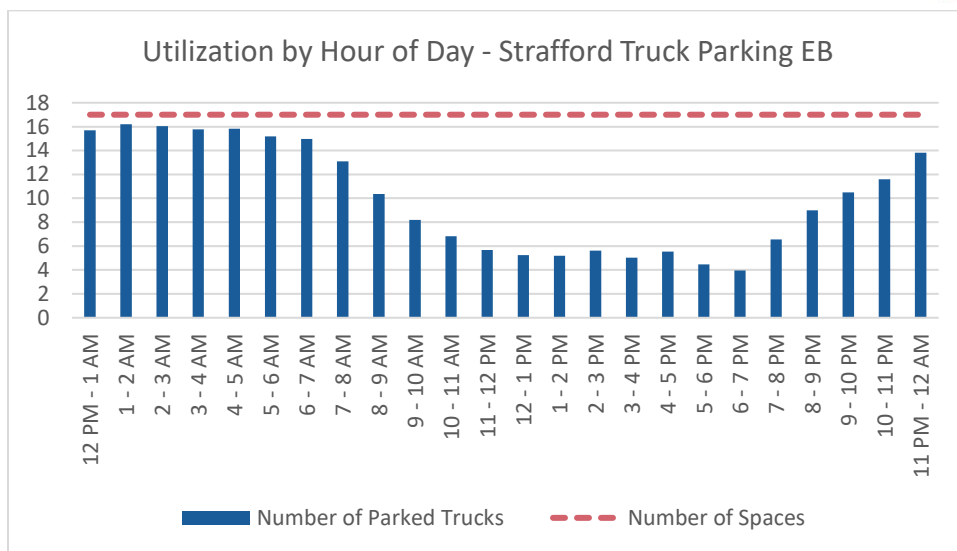
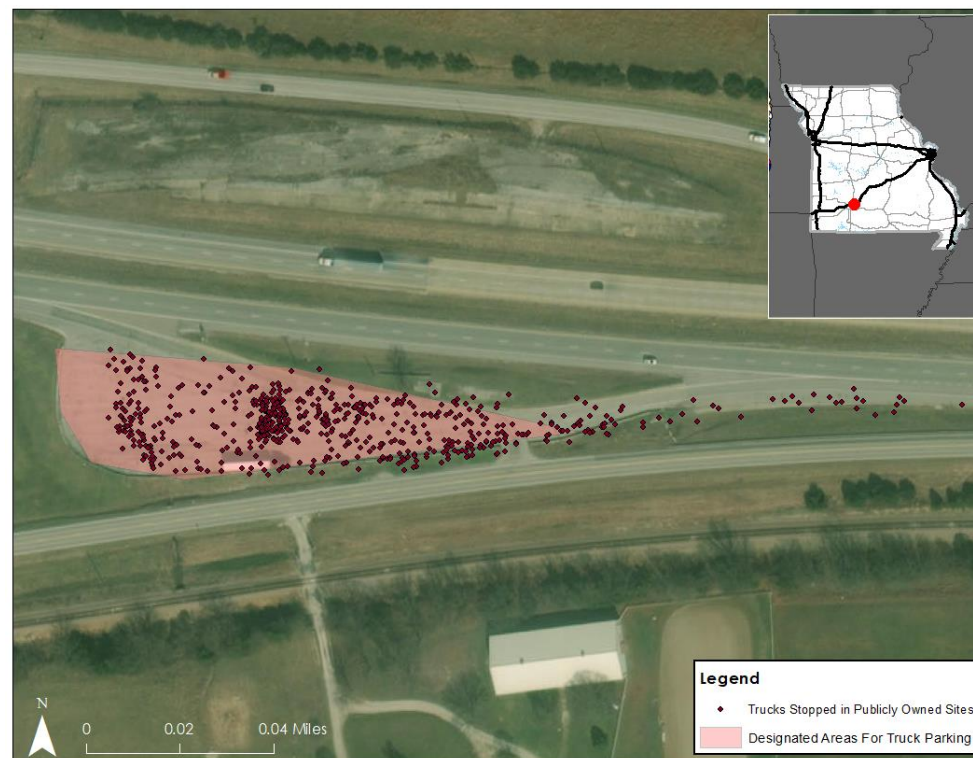
Utilization by Hour of Day - Steele Truck Parking SB





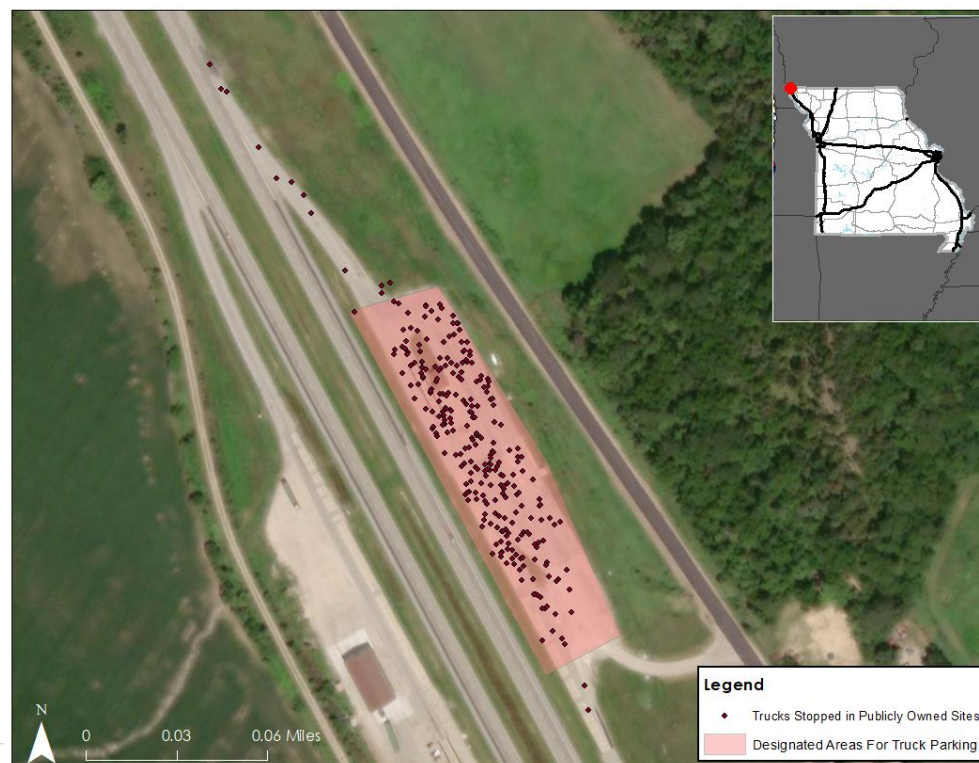
# **Strafford Truck Parking Area Eastbound (EB)**

Key Attributes	
Highway & Direction	I-44 EB
County	Greene
Latitude, Longitude	37.270639, -93.102396
Inventory (Number of Spaces)	17
Statewide Peak Hour (2-3 AM) Utilization	94%
Restrooms	No
Lighting	Yes
Trash Cans	No
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	No
Pet/Picnic Area	No

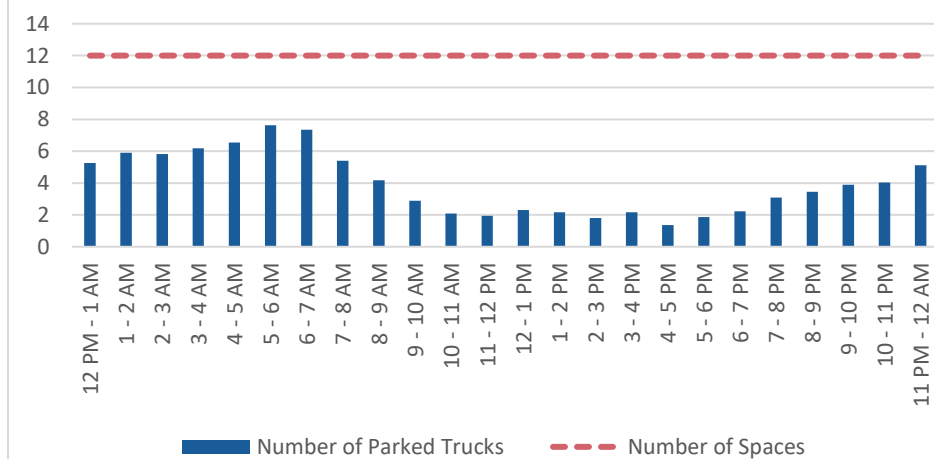


## Watson Truck Parking Area Northbound (NB)

Key Attributes	
Highway & Direction	I-29 NB
County	Atchison
Latitude, Longitude	40.550822, -95.627705
Inventory (Number of Spaces)	12
Statewide Peak Hour (2-3 AM) Utilization	49%
Restrooms	No
Lighting	Yes
Trash Cans	No
Striped Parking	No
Angled Parking	No
Vending Machine	No
Pet/Picnic Area	No



Utilization by Hour of Day - Watson Truck Parking NB



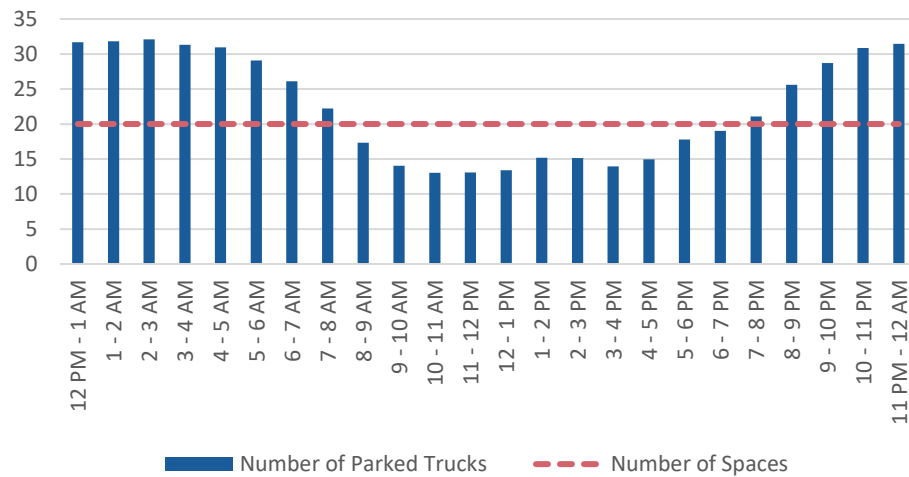
## TRUCK PARKING PROFILE

### Wright City Rest Area Eastbound (EB) & Westbound (WB)

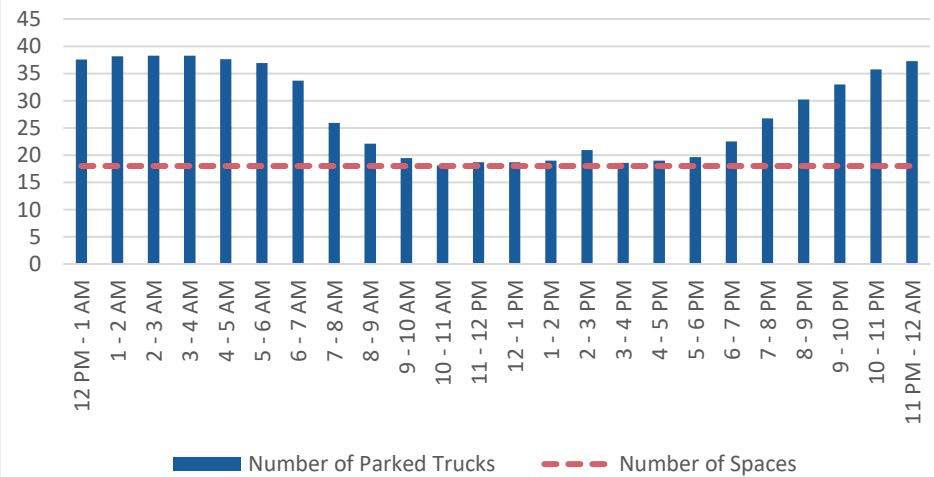
Key Attributes	
Highway & Direction	I-70 EB & WB
County	Warren
Latitude, Longitude	38.8274, -91.054686; 38.828536, -91.050803
Inventory (Number of Spaces)	18
Statewide Peak Hour (2-3 AM) Utilization	213%
Restrooms	Yes
Lighting	Yes
Trash Cans	Yes
Striped Parking	Yes
Angled Parking	Yes
Vending Machine	Yes
Pet/Picnic Area	Yes



Utilization by Hour of Day - Wright City Rest Area EB



Utilization by Hour of Day - Wright City Rest Area WB







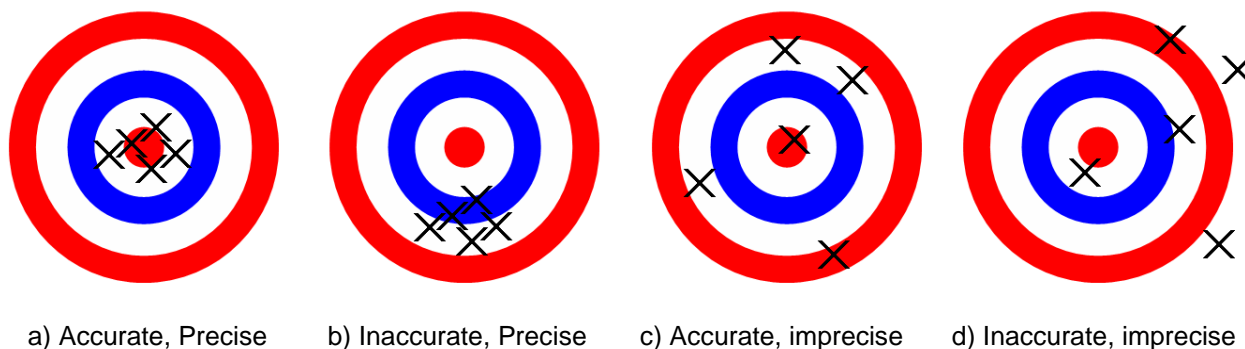


## Appendix B. Truck Parking GPS Data Preparation

This study is focused on identifying locations where trucks park rather than fully understanding travel patterns of individual vehicles. In order to determine parking behavior in a state where many facilities are located close to roadways and other businesses, a high level of accuracy and precision is necessary. These two terms are often used interchangeably, but they are important concepts when using location data of any type. Figure 3.6 provides an illustration of the definition applied for this study.

For truck parking, the points must be precise enough to distinguish between those inside a lot and those in another nearby facility. This is especially true when identifying overflow from legal parking areas into illegal spaces and when competing parking facilities are near each other. Imprecise data, like in target c) below, would produce a scattershot of stops in and around a lot. Rules which draw a border tightly around the space would erroneously miss many points. Points from trucks not in the facility of interest may land within the facility. Inaccurate reporting, as in b) and d), could bias the data by putting shifting points in a particular direction, resulting in similar issues to imprecision.

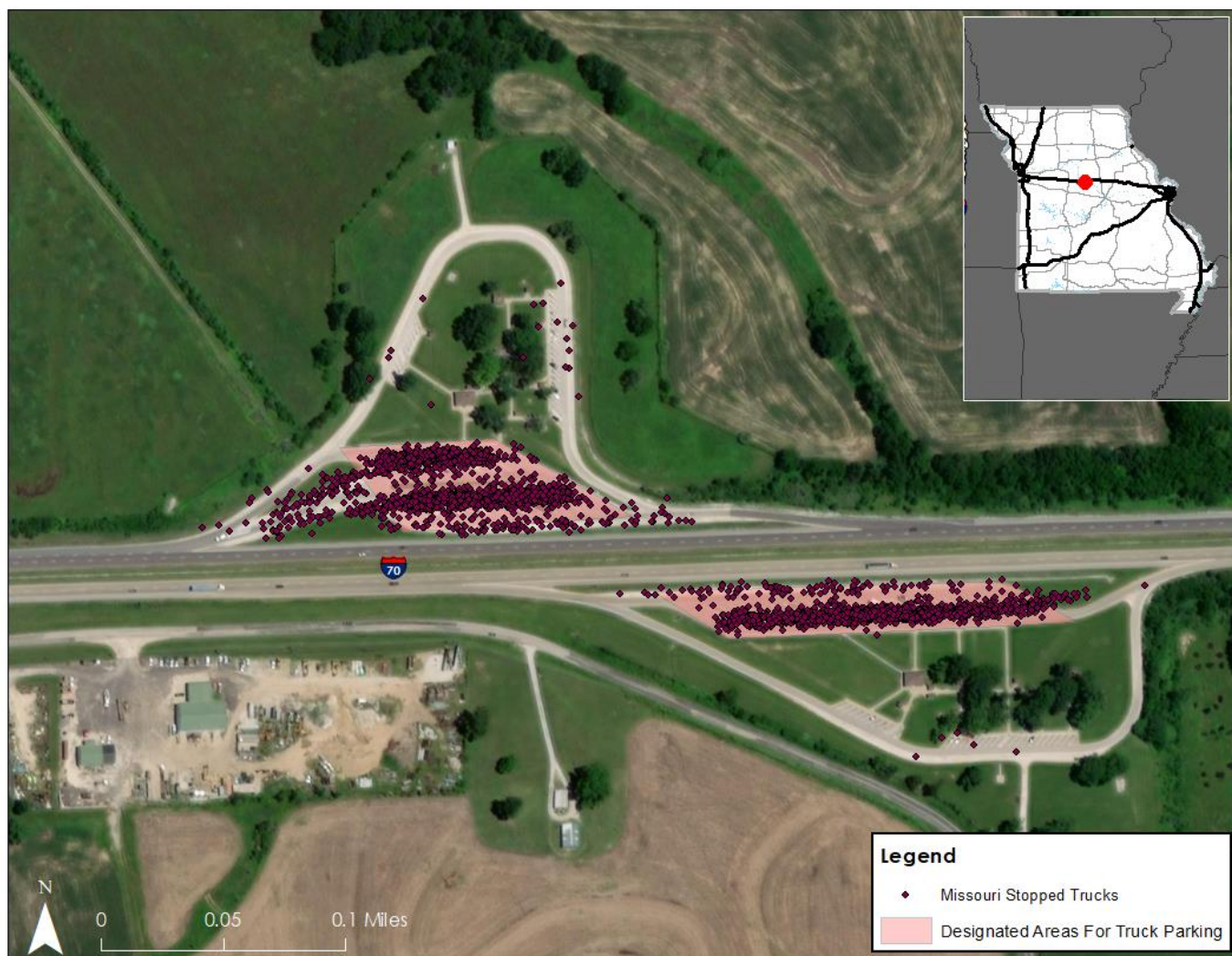
**FIGURE 3.6**    **DIAGRAM OF ACCURACY AND PRECISION**



Source: Cambridge Systematics (2019).

Raw GPS data from ATRI is fortunately accurate and precise. Figure 3.7 contains records of a sample of 3,275 stops over the data collection period. While there are too many to clearly see each point even with a sample, they form an outline of the places where trucks go. This allows the team to precisely identify trucks parked on the interstate ROW and within designated truck parking sites, but excludes trucks parked at private businesses or other locations that are beyond the scope of this study.

FIGURE 3.7 EXAMPLE OF RAW DATA POINTS AT BOONVILLE REST AREA



Source: ATRI. Analysis by Cambridge Systematics (2020).

## B.1 Data Handling and Pre-Processing

The datasets from the four time periods identified in Table 2.5 were received and handled separately but using the same process. The programming language Spark (implemented in Python) was used first as it is designed specifically to handle large datasets. Spark read and combined all the data – inside and outside of the geographic buffer for this project – for each period. After filtering out unused out of state points, assigning new truck ids, sorting and doing some other formatting changes, data were exported into a series of smaller files, each containing mutually exclusive sets of trucks. The smaller files could be more easily managed in R and run independently.

The next step occurred in R and prepared the data for the main processing steps. Some minor cleaning was performed to preclude unnecessary or erroneous calculations. Additionally, initial calculations were made, and the

format of the data object set to save time in the next steps. Lastly, the (only slightly processed) data were summarized to show basic characteristics or unusual trends.

## B.2 Analysis

Setting up the processing steps required understanding the initial state of the data and the new state after each step. This generally consisted of checking overall changes like statistics describing what was dropped or kept. Maps of truck points showed how a random sample or a specifically targeted set of individual trucks' points were treated. Diagnostic runs allow for close examination of what was passing through each filter to become a "stop" by:

- Comparing results vs raw data;
- Comparing results vs previous step's results;
- Analysis of trip-stop patterns; and
- Checking of unusual rates of stopping, lengths of time, speeds, etc.

The result was a series of filters that dropped records, grouping algorithms that clustered multiple records together, and calculations which analyzed their status, along with the carefully honed parameters which controlled them. Each step was closely monitored to address the following questions:

1. Was anything filtered out or changed that should have remained?
2. Was anything retained that should have been dropped or changed?
3. If yes for either of the first two, is this the step to take care of it or is there a later step that will?

When the answer for question three was "yes", changes were made and tested until a desired result was reached. Not every pause in a truck's movement is a stop and not every stop consists of many reports at exactly the same location. Consequently, the heuristic approach requires repeatedly taking different perspectives of each trace while carrying along the information inferred in previous steps. As the process progressed, the number of data points decreased, and the changes became more limited and precise. Early steps allowed a lot of non-"stops" through to avoid taking out the real ones. For many trucks, the later stages had no impact on their attributes because their stops were already identified.

At a high level, the initial data processing steps included:

- Process data using proprietary series of filtering and analysis steps.
  - » Remove erroneous points or trucks which have less than 10 records.
  - » Cluster consecutive points which occur within a certain distance of a location, (e.g., within a parking area).
  - » Use further fine tuning to separate stopping activity from moving activity.



- » Produce a dataset of stops which trucks made.
- Identify and categorize parking.
  - » Overlay all stops onto polygons of ROW and parking locations.
    - Remove any other stops as outside the scope of this analysis (e.g., trucks stopped at a private, non-truck parking business).
  - » Develop attributes for stopping event including start/end time, length of stay and location.

## B.3 Post Processing and Special Cases

Due to the limited geographic scope of the data (limited to within ½ mile of the interstate ROW in Missouri), information about what happens when a truck leaves this area is not available. This created a couple of issues that had to be resolved. In general, the team took a conservative approach to the data meaning that reported results may undercount the actual demand at some locations:

- Some stops which occurred on the first day of a data gathering period started before the first day (e.g., a truck which is parked at 9 p.m. the day before our study period and driven away at 6 a.m.).
  - » The start time of a stop in progress at the start of the data does not have a known arrival time.
  - » Trucks which are turned off do not report points, meaning that the example truck which is parked until 6am does not record data until its engine is started at that time. This truck might be at the location at midnight but not positively identified until hours later.
  - » To avoid erroneously classifying the parking usage of this truck and miscounting demand, all stops which end on the first day are removed from analysis. The converse is true for the end – all stops which start on the last day are removed as we cannot determine at what time they left the location after the data collection period ends.
  - » In summary, stops which occurred on (completely or partially) the 2nd to 13th days of each period are used.
- Consideration of partial missing data.
  - » Because records which occur away from the interstate system are not in the data, and, to a lesser extent, recording issues can occur, there are gaps in the traces of some trucks.
    - For example, a truck which does not have records for an extended period of time (two hours) between two points in different places experiences a “blackout”. (e.g., a truck that leaves an interstate and enters another three hours and 50 miles away)
  - » If this occurs at the end of a parking stop then the departure time from that stop is unclear (as well as the arrival time if the data prior is missing).
  - » The methodology estimated a maximum stop time by calculating the time gap minus the minimum travel time to next known point. However, reported results only use the time in which the truck was known to be at the parking stop location – the time from the first to the last GPS record there.

- Speed filter
  - » Some clusters of “stops” were being shown in the middle of the interstate ROW but with speed values >5 mph. These “stops” were eliminated from the data.

# Appendix C. Truck Driver Survey Questions

## C.1 Demographic/Fleet Questions

**Which of the following best describes your employment (choose all that apply)?**

- Employee driver
- Team driver
- Owner-Operator/Independent driver leased to a company
- Owner-Operator/Independent driver with own operating authority
- Fleet executive/manager/dispatcher
- Other (please explain)

**Gender Identity (choose one)?**

- Male
- Female
- Prefer not to answer

**What best describes your typical length of haul (choose one)?**

- Local (less than 100 miles)
- Regional (100-499 miles)
- Interregional (500-999 miles)
- Long-haul (1000+)
- Varies
- Don't know/does not apply

**What is the primary vehicle configuration that you typically operate (choose one)?**

- 5-axle dry van
- 5-axle refrigerated trailer
- 5-axle flatbed
- 5-axle tanker

- Straight truck
- Oversize
- Varies
- Other (please explain)

**How often do you operate in Missouri (select all that apply)?**

- Daily
- Weekly
- Monthly
- Rarely
- Never

## C.2 Truck Parking Needs

**What type of truck parking do you regularly need in Missouri (select all that apply)?**

- Overnight/10-hr break
- Staging parking (1-4 hours)
- 30 minute rest break
- Parking during time off/34-hr reset
- Emergency parking (due to unanticipated weather or road conditions)
- Other (please explain)

**How difficult is it to find these different types of truck parking in Missouri (rate)?** [Rate each option: I don't know/I don't need this type of parking; Not difficult; Somewhat difficult; or Very difficult]

- Overnight/10-hr break
- Staging parking (1-4 hours)
- 30 minute rest break
- Parking during time off/34-hr reset
- Emergency parking (due to unanticipated weather or road conditions)



- Comment box (Please describe any specific areas of concern. For example “Not enough parking spaces at X Rest Area, it is always full”.)

**How do you typically find truck parking in any state you operate in (choose all that apply)?**

- Drive around an area to look for available parking
- Talk with other drivers (CB radio)
- Use a truck parking mobile app.
- Static roadside signs
- Real time information signs (in states where this is available)
- Reserve parking with a private truck parking facility prior to trip
- Other (please explain)

**How much time do you typically spend searching for truck parking in Missouri (choose one)?**

- Less than 15 minutes
- 15-30 minutes
- 30-45 minutes
- 45 minutes to an hour
- More than an hour

**Compared to other states you travel in, how easy is it to find safe truck parking in Missouri (choose one)?**

- Much easier to find parking in Missouri
- A little easier to find parking in Missouri
- About the same
- A little harder to find parking in Missouri
- Much harder to find parking in Missouri
- I don't know/I don't need parking in other states

**How often do you park in an undesignated area such as the side of road, a vacant property, etc. in Missouri (choose one)?**

- Once a day
- Multiple times a day
- Once a week
- Multiple times a week
- Does not apply
- Not sure

**What type of parking do you typically use public truck parking sites in Missouri for (select all that apply)?**

- Overnight/10-hr break
- Staging parking (1-4 hours)
- 30 minute rest break
- Parking during time off/34-hr reset
- Emergency parking (due to unanticipated weather or road conditions)
- Don't know/Does not apply

**Please rank in order of importance each amenity at public truck parking sites (rank 1-12 with 1 as most important):**

- Defined/Striped oversize vehicle parking spaces
- Driver lounge
- Enhanced vending machines (better food options, basic toiletries, etc.)
- Fencing
- Flushing Toilets
- Green space and walking paths
- Lighting

- Paved/striped spaces
- Real time parking space availability information
- Vault Toilets
- Wi-Fi
- Other Amenity (please explain)

**Missouri has a number of truck parking only facilities with limited amenities (lighting, some with vault toilets, trash). What is your opinion of these sites?**

- They are great, I use them regularly
- They are ok, I use them sometimes
- They are not good, I try not to use them
- They are really bad, I don't use them
- No opinion

**Follow-up question if answer is “ok”, “not good”, or “really bad” to the above: What could be done to make these sites better?**

- Add basic amenities (vault toilet, lighting, fencing, paved and striped spaces)
- Add enhanced amenities (truck parking availability, enhanced vending machines, flushable toilets, restrooms, Wi-Fi)
- Add more truck parking spaces
- Add defined/striped spaces for oversize trucks
- Increase enforcement to keep non-trucks out
- Other (please explain)

**How useful would a system that tells you whether spots are available at nearby public parking sites in Missouri (a truck parking availability system) on the following corridors (rate)?** [Rate each option: Very useful; Somewhat useful; or Not very useful]

- I-29

- I-35
- I-44
- I-49
- I-55
- I-57
- I-70

**How often do you deal with the following issues in Missouri (rate)?** [Rate each option: Always; Often; Sometimes; Rarely; or Never]

- I have to move after parking because of rest area time limit restrictions
- There are no designated places to park nearby, so I park on highway ramps or shoulders
- Because I cannot park on-site while waiting to make a delivery, I park on local roads, in parking lots of retail stores, or in empty/abandoned parking lots nearby while waiting for my delivery appointment or to be called to the dock.
- I am asked to move by enforcement if parked in an undesignated location
- My truck is damaged while parked
- I cannot find parking for an oversize vehicle configuration
- There is a lack of amenities at public parking sites
- I do not know where to find information on where truck parking sites are located.
- There is a lack of real-time information about how many spaces are available at parking sites

**We will be holding a driver forum/roundtable later in the year. This will be a chance for drivers to provide more detailed input on truck parking issues including specific areas of need and recommendations. Would you be interested in participating?**

- Yes (space to provide name and email address)
- No



## Appendix D. Truck Driver Roundtable Question Guide

- Compared to other states you travel in, how easy is it to find safe truck parking in Missouri?
- Tell us one thing Missouri is doing right regarding truck parking that it should keep doing.
- Tell us one thing Missouri should stop doing or do differently regarding truck parking.
- Tell us one location where would you like to see more truck parking.
- If you drive Missouri U.S. Routes, where would you like to see more truck parking?
- If MoDOT added more truck parking facilities, which 2 amenities are most critical: lighting, fence, vault toilet, trash can, paved lot, or striped spots?
- If MoDOT added more truck parking, which is more critical: spaces on Interstates in rural Missouri, or spaces in urban areas?
- How do you typically find truck parking in any state that you operate in? Drive around, use app, other drivers, etc.?
- MoDOT does not currently provide electronic, advance notice of truck parking availability due to limited funding. Which would you prefer – more parking or advance notice of parking availability?
- What's the best way that MoDOT can communicate with drivers who are on the road, behind the wheel?
- *If there's time – specific interstate ROW parking questions:*
  - » Data show that about 60% of truck stops on MO Interstate ROW lasted for less than 1 hour, and 21% lasted between 1-4 hours. Can you help us understand why a driver might have to park in the ROW for a given period of time?
  - » The peak hour for trucks stopped on MO interstate ROW is between 5 and 6 a.m., slightly later than the peak hour across designated truck parking sites (2 - 3 a.m.). The reason for this difference in peak hour activity is unclear - can you tell us why this may be? Could it be related to staging/waiting for a delivery window?
  - » I-70 in St. Louis City has the highest number of trucks parked on ROW interstate centerline miles. The relative lack of inventory in the St. Louis area combined with a large number of businesses and residents requiring service may be contributing to this. Does this seem like the right interpretation?

- » Our data show that the Mineola Truck Parking Facility (I-70 in Montgomery County) is under capacity at the peak hour, but has high levels of trucks parked on the ROW. Why might this be the case? During 2019 the westbound bridge @ Mineola had a 10' 9" width restriction, could that have led to more ROW parking?